GETTING LEAD OFF THE LANDSCAPE

A theory and data-driven approach to increase non-lead ammunition use among hunters in the California condor range of Utah (USA)

Jacob C. Richards & Jordan W. Smith, Ph.D.
Institute of Outdoor Recreation and Tourism, Utah State University

ABOUT THE INSTITUTE

The Institute of Outdoor Recreation and Tourism was founded in 1998 by the Utah State Legislature through the Recreation and Tourism Research and Extension Program Act (S.B. 35). The Institute is mandated to focus on: tourism and outdoor recreation use; the social and economic tradeoffs of tourism and outdoor recreation for local communities; and the relationship between outdoor recreation and tourism and public land management practices and policies.

The purpose of the Institute is to provide: better data for the Legislature and state agencies in their decision-making processes on issues relating to tourism and outdoor recreation; a base of information and expertise to assist community officials as they attempt to balance the economic, social, and environmental tradeoffs in tourism development; and an interdisciplinary approach of research and study on outdoor recreation and tourism, a complex sector of the state's economy.

The Institute's academic program offers both a bachelor's and a master's degree in Recreation Resource Management. Our academic program also contributes to Environment and Society, a doctoral program offered within the S.J. and Jessie E. Quinney College of Natural Resources at Utah State University.

Jacob C. Richards is an MS student in Recreation Resource Management with research focused on developing effective communication strategies to increase use of non-lead ammunition in the California condor recovery zone. Originally from Vermont, Jake has undergraduate degrees in History and Environmental Science, and completed the Teton Science Schools' Graduate Program in Jackson Hole, Wyoming. He also currently works as a wildlife guide on public lands across the American West.

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EXECUTIVE SUMMARY

Purpose

The leading cause of mortality in California condors (condors) is lead poisoning, which occurs when condors ingest lead-based ammunition left in carcasses. As a critically endangered species with approximately 100 individuals remaining in the American southwest, increasing the adoption of non-lead ammunition is essential to the recovery of the species. In Utah, the Division of Wildlife Resources (DWR) uses communication with hunters as the primary tool for increasing the adoption of non-lead ammunition in southwestern Utah. In this research, we use social science theory and data collected from a survey of hunters throughout the region to develop a strategic communication framework aimed at increasing the use of non-lead ammunition among hunters. The strategic communication framework is intended to drive more specific, targeted, and effective messages regarding the use of non-lead ammunition by the Utah Division of Wildlife Resources and their conservation partners.

Methods

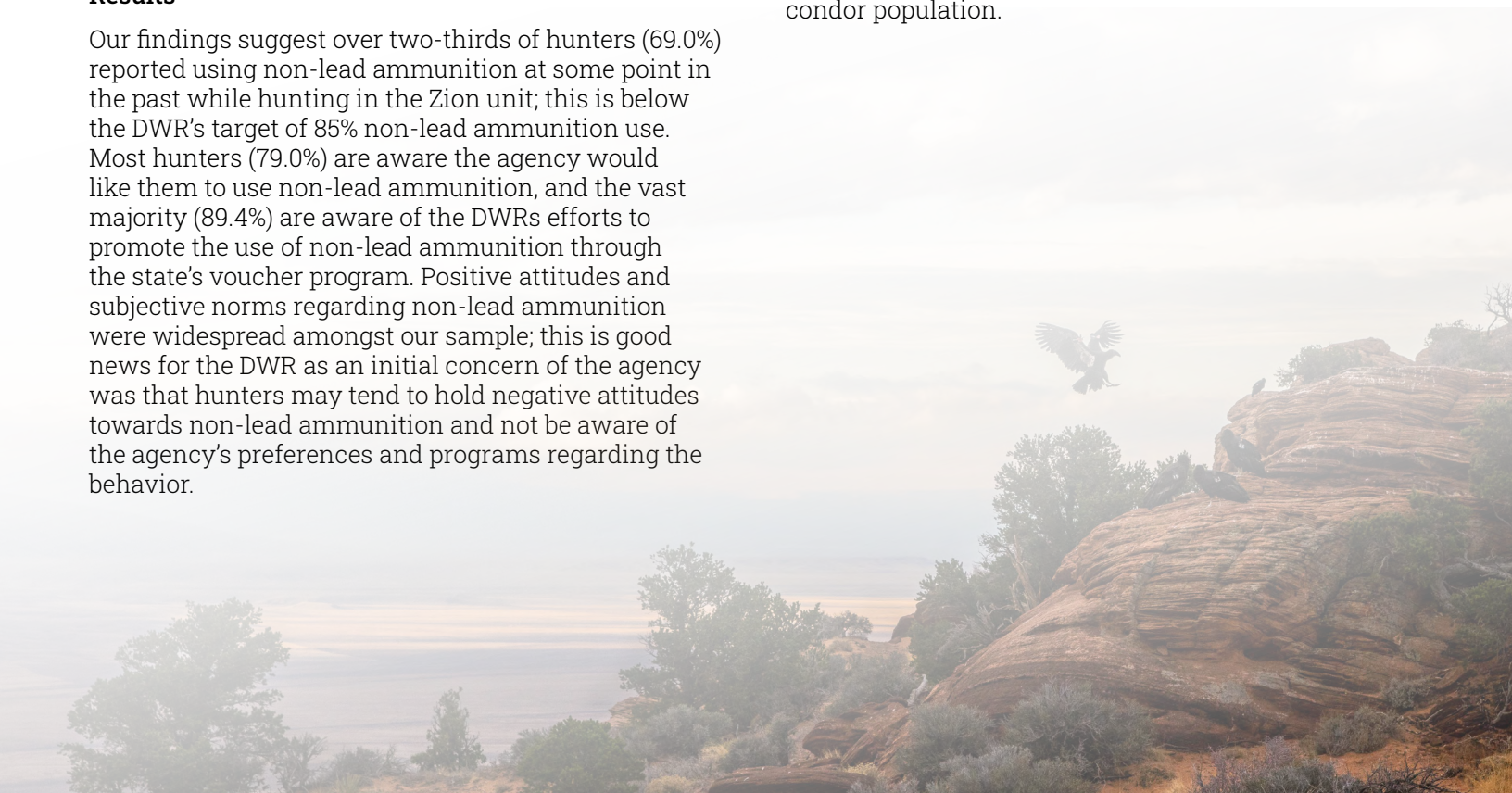
We collected data via an online survey administered to all hunters who had drawn a big game (deer) permit in the Zion hunting unit from 2017 to 2021. Email addresses were acquired courtesy of the DWR licensing department. In total, we collected 1,752 valid survey responses, with a response rate of 27.2%.

Results

Our findings suggest over two-thirds of hunters (69.0%) reported using non-lead ammunition at some point in the past while hunting in the Zion unit; this is below the DWR's target of 85% non-lead ammunition use. Most hunters (79.0%) are aware the agency would like them to use non-lead ammunition, and the vast majority (89.4%) are aware of the DWRs efforts to promote the use of non-lead ammunition through the state's voucher program. Positive attitudes and subjective norms regarding non-lead ammunition were widespread amongst our sample; this is good news for the DWR as an initial concern of the agency was that hunters may tend to hold negative attitudes towards non-lead ammunition and not be aware of the agency's preferences and programs regarding the behavior.

One of the greatest barriers to increased non-lead ammunition use is supply shortages. Many hunters indicated an intention to use non-lead ammunition in the Zion area, but also noted they were unable to find it in their preferred caliber. The shortage of non-lead ammunition has become an acute problem over the past two years, largely due to global delays in supply chains. We found only 22.2% of hunters who drew a tag in 2017 indicated they were unable to purchase non-lead ammunition due to supply shortages; this number more than doubled to 46.6% for those hunters who had drawn a tag in 2021. Unless global supply chain issues are rectified soon, they may lead to unforeseen negative consequences for the condor population.

We asked hunters to self-report feelings of stewardship for the landscape and for the hunting tradition, believing these feelings could be used as key leverage points to encourage the use of non-lead ammunition. These 'personal norms' were very strong amongst hunters; 92.7% of hunters consider themselves to be a steward of the natural landscape where they hunt and 88.4% believe they are stewards of the hunting tradition for future generations. Given these findings, we provide specific guidance on how the DWR can target personal norms in their communication with hunters regarding the use of non-lead ammunition. Tapping into feelings of stewardship over the landscape and family traditions are likely to be the most effective at causing behavioral change, reducing the use of lead ammunition, and conserving the condor population.



INTRODUCTION

Overview

The ingestion of lead from spent ammunition in carcasses is the leading cause of mortality among condors (Finkelstein et al., 2012; Sieg et al., 2009). Numerous studies agree that the greatest need and opportunity to continue towards a self-sustainable wild population of condors is to remove lead-contaminated carcasses from the landscape (Finkelstein et al., 2012). It is estimated that 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). The purpose of this project is to use social science theory and data collected from a survey of hunters throughout southwestern Utah to develop a strategic communication framework aimed at increasing the use of non-lead ammunition among hunters.

Previous research attempting to change hunter behavior has noted hunters see themselves as stewards and conservationists, and collaboration should be pursued through voluntary efforts to ensure maximum success (Epps, 2014). Voluntary adoption has proven to be a very successful strategy in other condor habitats such as Arizona and is more politically attractive to state agencies when compared to bans on the use of lead ammunition (Chase & Rabe, 2015). Given this, efforts to increase the voluntary use of non-lead ammunition need to be informed by both theories of human behavior (as they help us understand why people tend to behave in certain ways) and context-specific data about the attitudes and perceptions of the hunters who will be the target of persuasive communication efforts.

Communication strategies grounded in a strong theoretical foundation are significantly more effective than those not guided by theory (Lessard et al., 2021; Teel et al., 2015). There are several theories of human behavior proven to be effective in understanding the antecedents of environmentally responsible behaviors. The Theory of Planned Behavior (TPB; Armitage & Conner, 2001) is foremost among these, particularly within the realm of wildlife conservation. The theory postulates there are three primary determinants of behavioral intention: attitudes, subjective norms, and perceived behavioral control (Figure 1). An attitude towards a behavior is the degree of favorability the individual holds towards it. The subjective norm is the social component, where an individual evaluates the perceived attitudes of their social group(s) towards an object and feels a certain pressure to perform or not perform the behavior. Finally, perceived behavioral control is the predicted difficulty of the behavior by the individual, and can be significantly influenced by past behavior, as well as factors such as cost, complexity, or self-efficacy (Ajzen, 1991). In addition to attitudes, subjective norms, and perceived behavioral control, we also measure feelings of stewardship held by hunters in the Zion area, as these are personal norms that could be further targeted by communication strategies and could be some of the most influential predictors of non-lead ammunition use.

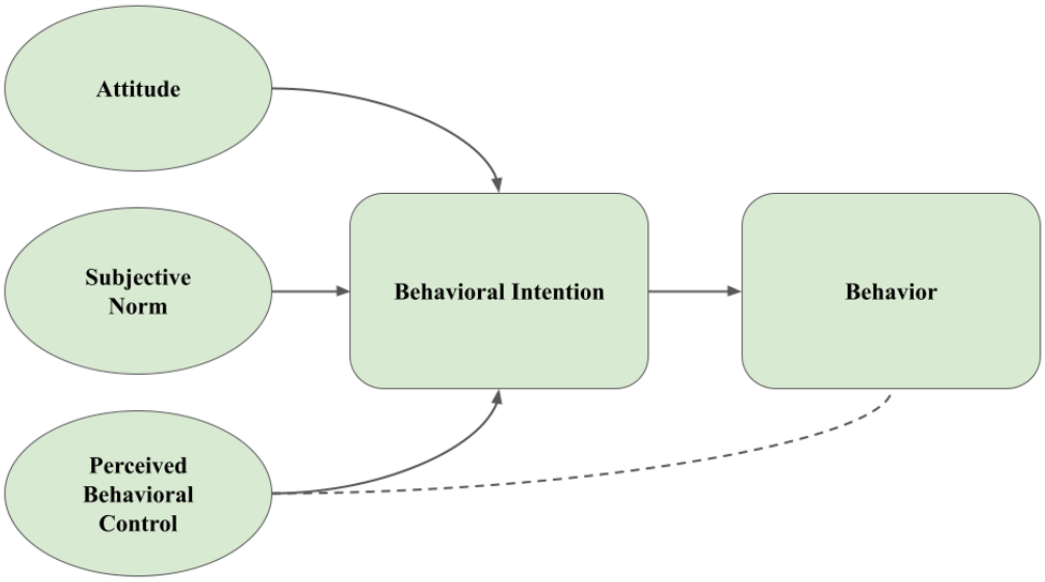


Figure 1. Components of the Theory of Planned Behavior.

Study Area

While our survey was administered electronically, it was only sent to hunters who drew big game (deer) permits in the Zion hunting unit (Figure 2). This area contains California condor nesting and foraging areas, and efforts to increase non-lead ammunition use in this region will support the continued recovery of the endangered species.

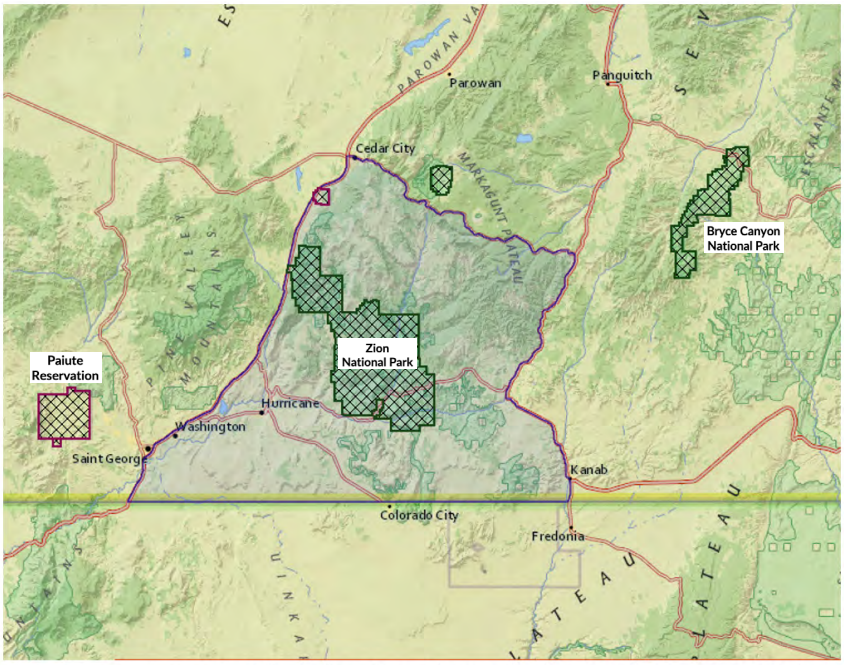


Figure 2. A map of the Zion hunting unit in southwestern Utah.

METHODS

Survey Development

We collaboratively developed the survey instrument with the DWR. The instrument was developed to measure context specific attitudes, subjective norms, and perceptions of behaviors control in accordance with the current development of the TPB. The instrument also included questions to measure personal norms as we believed these may be particularly relevant for hunters. The instrument also included practical management questions related to non-lead ammunition use in the Zion area as well as basic sociodemographic questions to characterize the sample population.

The instrument was divided into five sections:

1. Recent Zion area hunting behavior
2. Information sources and ammunition preferences
3. Historical non-lead ammunition use
4. Perceptions about using non-lead ammunition
5. Sociodemographic characteristics

Questions regarding hunting behavior, information sources, and ammunition preferences were based on similar instruments found in the literature as well as provided by the DWR or others we had reached out to during the survey development process (e.g., The Peregrine Fund). Psychometric questions targeting the psychological constructs of TPB were based on other research testing the same constructs. In total, the instrument included a total of 43 questions or statement items. The full survey instrument is included in the Appendix.

Sampling Design

DWR provided us with the email addresses of all hunters who successfully drew a deer permit in the Zion hunting unit from 2017 – 2021. By using this five-year span, our intention was to balance accurate responses (from more recent self-reported behaviors) with the increased generalizability that comes from larger samples. We particularly wanted to sample hunters who had hunted in the area before 2020, as travel behaviors since then may have been impacted by the COVID-19 pandemic (CAHSS, 2021). Successful deer permit applicants were chosen because they are the largest big-game hunting population in this area and could be targeted geographically since the permits are specific to the Zion area.

After removing duplicates, we were left with 6,453 unique email addresses. Since electronic surveys sent via email have a relatively low response rate, we decided to send the survey to all 6,453 addresses.

Data Collection

The survey was first sent on November 5, 2021, with four follow up emails sent on November 10, 15, 18, and 23. The survey results were exported from Qualtrics to SPSS on December 6, 2021. A total of 77 participants opened the survey but declined to participate via the initial consent form, while 1,845 agreed to participate. 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 their responses were deleted as well. In total, we received 1,752 valid responses with usable data. This final number puts our overall response rate at 27.2%. The number of responses and the response rate by year is shown in Table 1. The response rate exceeded our expectations (target response numbers were n > 650, response rate > 10%).

Data Management and Analysis

All data analysis was done in SPSS v.28 and data were stored on the Institute of Outdoor Recreation and Tourism's lab computers and servers.

Table 1

Survey distribution and response rate by year

Permit Year	Emails Sent	Valid Survey Responses	Response Rate
2021	2,130	747	35.1%
2020	1,694	430	25.4%
2019	1,143	258	22.6%
2018	850	170	20.0%
2017	636	147	23.1%
Totals	6,453	1,752	27.2%

Note. Many hunters in this area apply for big game permits across multiple years, so the contact list was cleaned of all duplicate emails; this is why the number of emails sent decreases from 2021 to 2017.

FINDINGS

Sociodemographic Characteristics

Survey respondents' demographic characteristics are described in Table 2. A majority of respondents were Utah residents (82.2%), and were also male (88.3%). The average respondent age was 50 years old, with a standard deviation of 14.6. Participant ages ranged from 18 to 88. Participant income levels were normally distributed, with an average (mode) between $100,000-149,999.

Hunting Behavior

Respondents tended to be experienced hunters, having hunted for an average of nearly 30 years (mean = 29.8, SD = 16.7). Respondents hunted an average of 5 days in the Zion unit in the previous 12 months (mean = 5.0, SD = 7.9). Over one-third of respondents (36.4%) reported hunting 0 days in the previous 12 months, which reflects the multi-year nature of our dataset. If a hunter did hunt at least one day in the previous 12-month period, the mean number of hunting days in the area was 8.2 (SD = 8.7).

Deer was the most targeted species within the Zion area, being targeted by 94.0% of hunters who had hunted within the area over the previous 12 months. This is to be expected as the database used for our sample was hunters who had drawn deer tags for the unit. The next most targeted species was elk (22.0%), upland game birds/wild turkey (4.9%), and "other" species (1.9%). Participants primarily used the "other" category to refer to hunting coyotes and

Table 2

Sociodemographic characteristics of the Zion hunter survey respondents

Sociodemographic Characteristic	Category	n	%
Age	18-29	123	9.1
(n = 1,345)	30-39	225	16.7
	40-49	309	23.0
	50-59	276	20.5
	60-69	260	19.3
	70+	152	11.3
Gender	Female	79	5.9
(n = 1,349)	Male	1,191	88.3
	Prefer not to answer	58	4.3
	I prefer to self-describe	21	1.6
Annual Household Income (2020)	$0 - $19,999	28	2.1
(n = 1,342)	$20,000 - $39,999	66	4.9
	$40,000 - $59,999	125	9.3
	$60,000 - $79,999	178	13.3
	$80,000 - $99,999	199	14.8
	$100,000 - $149,999	283	21.1
	$150,000 - $199,999	127	9.5
	$200,000+	127	9.5
	Prefer not to answer	209	15.6
State of Residence	Utah	927	82.2
(n = 1,128)	California	66	5.9
	Arizona	41	3.6
	Nevada	33	2.9
	Other	61	5.4

bobcats. Additional species included in our survey were bighorn sheep, pronghorn, black bear, cougar, migratory game and birds/waterfowl, all of which had percentages < 1% (Table 3).

Mean hunting days for each species are included in Table 3. This reflects the average number of days spent pursuing that species in the Zion area in the previous 12 months. Mean animals harvested is also included, which shows success levels for the same species within the previous 12 months. For example, the mean

Table 3

Type of game species targeted, mean days hunting, and mean number of animals harvested (n = 1,085)

			Days Hunted			Animals Harvested		
Type of Game	Frequency	%	Mean	LB	UB	Mean	LB	UB
Deer	1,020	94.0	6.6	1	22	0.4	0	3
Elk	239	22.0	8.0	1	33	0.1	0	1
Bighorn Sheep	3	0.3	15.3	1	40	0.5	0	1
Pronghorn	2	0.2	5.0	5	5	0.0	0	0
Black Bear	1	0.1	5.0	5	5	0.0	0	0
Cougar	11	1.0	6.3	1	20	0.0	0	0
Upland game birds/turkey	53	4.9	3.9	1	16	0.6	0	5
Migratory game birds/waterfowl/crow	0	0.0	9.8	3	25	3.8	0	7
Other	21	1.9	10.8	1	51	2.6	0	7

number of days spent pursuing deer in the Zion unit in the 12 months prior to survey participation was 6.6, with a range of 1-22 days, and the mean number of deer harvested by this same group is 0.4, with a range of 0-3.

Non-lead Ammunition Use, Availability, and Perceptions

Nearly 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. The breakdown of non-lead and lead ammunition use by hunt year is shown in Table 4.

A full 40% of hunters indicated they intended to use non-lead ammunition but were unable to find it in their preferred caliber. When disaggregated by hunt year, we see the shortage of ammunition has become a particularly acute problem in recent years. While only 34.5% of 2017 hunters indicated they intended to use non-lead ammunition but could not purchase it, the percentage increased to 46.0% for 2021 hunters (Table 5).

Of the individuals who have used non-lead ammunition within the Zion area at any time in the past, nearly half (48.5%) indicated using non-lead ammunition with their rifle; smaller proportions of the sample have used non-lead ammunition with another type of firearm (Table 6).

Table 4

Ammunition preferences and use within the Zion area

Permit Year	Percentage of hunters who used non-lead ammunition	Percentage of hunters who used lead ammunition
2021 (n = 716)	62.7	27.9
2020 (n = 412)	67.7	22.3
2019 (n = 245)	69.4	23.7
2018 (n = 161)	70.2	21.7
2017 (n = 140)	65.7	21.4
2017 – 2021 (n = 1,674)	65.9	24.8

Table 5

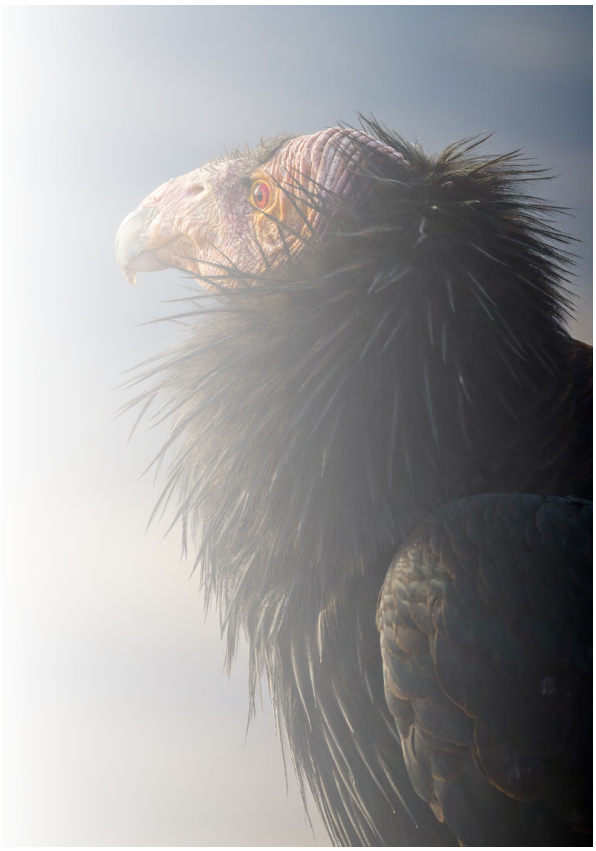
Percentage of hunters who intended to use non-lead ammunition but were unable to due to ammunition shortages

Permit Year	%
2021 (n = 198)	46.0
2020 (n = 91)	40.7
2019 (n = 57)	26.3
2018 (n = 35)	31.4
2017 (n = 29)	34.5
2017 – 2021 (n = 410)	40.0

Table 6

Type of firearms used with non-lead ammunition

Firearm type	Frequency	%
Rifle	932	48.5
Muzzleloader	221	11.5
Shotgun (shot)	49	2.5
Handgun	35	1.8
Shotgun (slugs)	8	0.4



Of the hunters who have used non-lead ammunition to hunt in the Zion area, 64.7% indicated they have harvested game in the region with non-lead ammunition. The distribution of game species harvested with non-lead ammunition is shown in Table 7.

Respondents who reported using non-lead ammunition were asked about their perceptions of certain characteristics of non-lead ammunition. Those who used non-lead ammunition still report concerns over cost and availability, but have favorable perceptions of its accuracy and lethality (Figure 3). Overall perceptions of non-lead ammunition are neutral, even among those who use non-lead ammunition.

Table 7

Type of game species harvested with non-lead ammunition

Species	Frequency	Mean number harvested (lifetime total)	SD	Range	
				LB	UB
Deer	624	3.4	3.3	1	15
Elk	131	2.1	1.8	0	8
Pronghorn	28	0.3	0.7	0	3
Black Bear	23	0.4	0.2	0	1
Cougar	25	0.2	0.5	0	2
Upland game birds	45	20.0	42.8	0	248
Waterfowl	30	16.9	36.7	0	129
Other	15	13.9	35.0	0	100

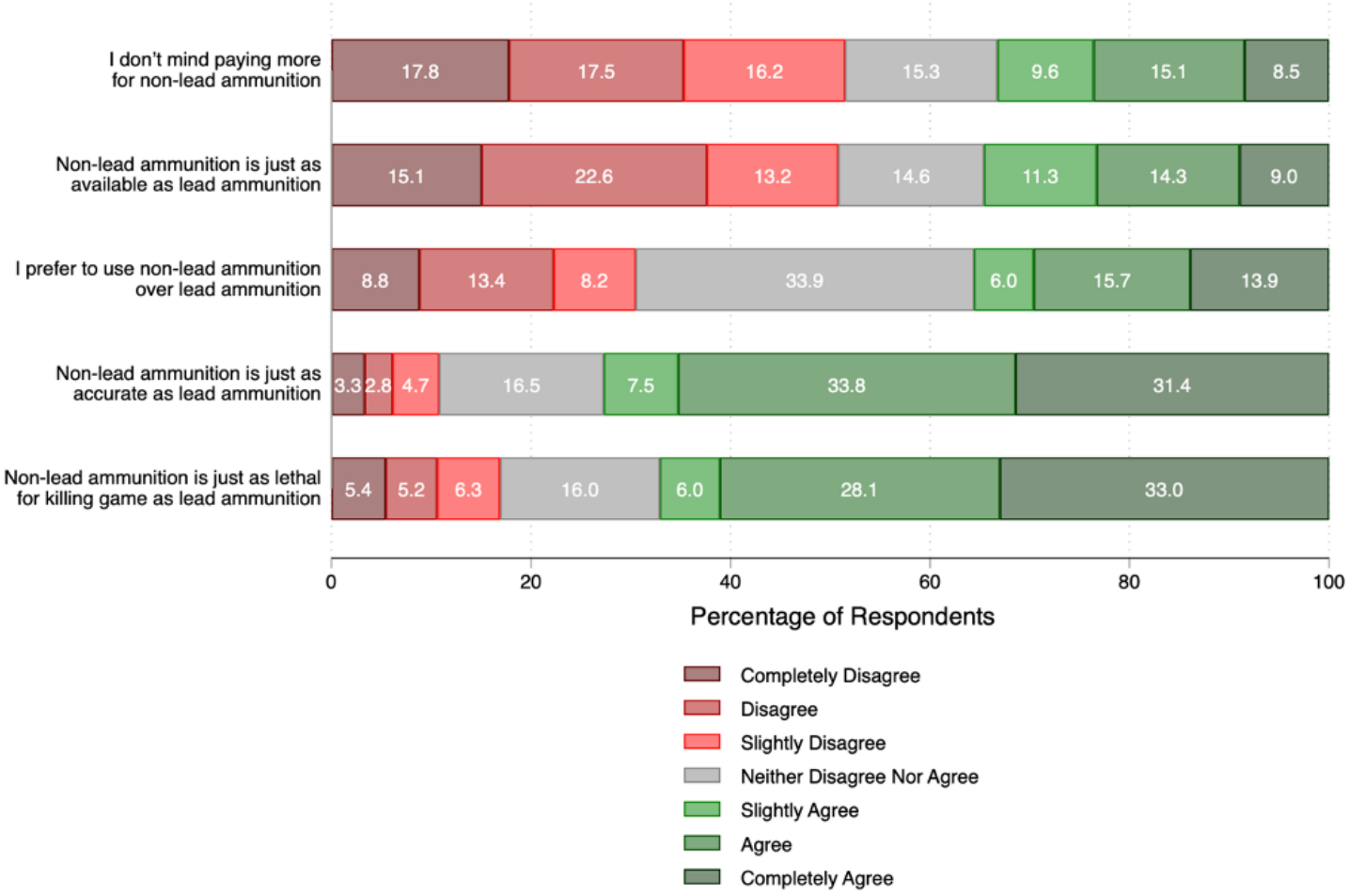


Figure 3. Perceptions of non-lead ammunition amongst non-lead ammunition users.

Respondents who reported using non-lead ammunition were then asked reasons why they chose non-lead ammunition; results are presented in Figure 4. Relatively few (12.4%-25.6%) respondents agreed that either performance or health reasons were why they used non-lead ammunition. However, 67.0% of respondents agreed that conservation motivations ("I do not want to harm other wildlife species") were why they chose to use non-lead ammunition.

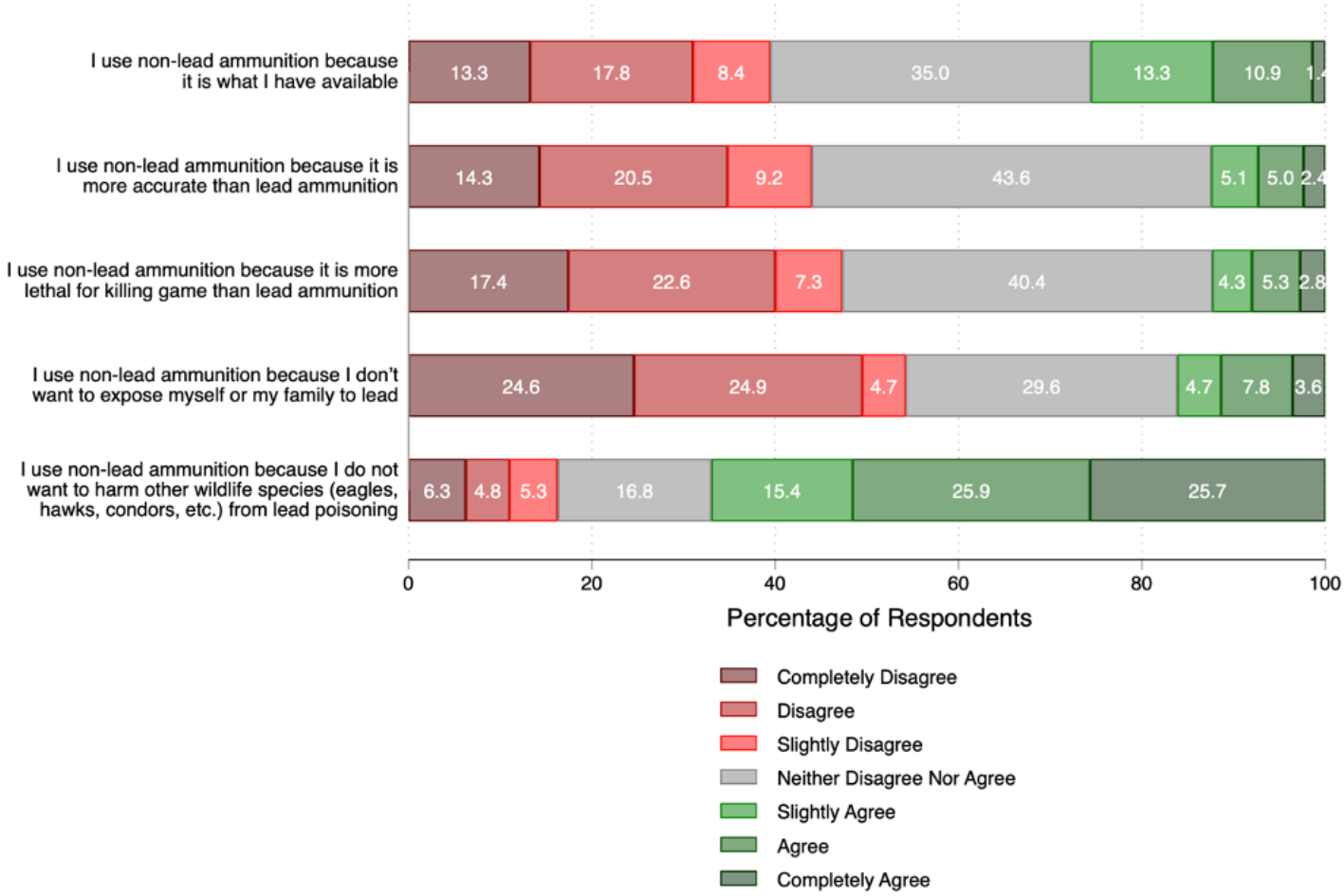


Figure 4. Reasons for using non-lead ammunition.

Respondents reporting they used lead ammunition were also asked about their motivations for that preference. As seen in Figure 5, most categories received a generally neutral response (the most commonly selected response was "neither disagree nor agree"). The exception was the amount of thought these respondents put into the bullet they select. More than 68% of respondents agreed they "put a lot of thought into what bullet/projectile [they] use for hunting."

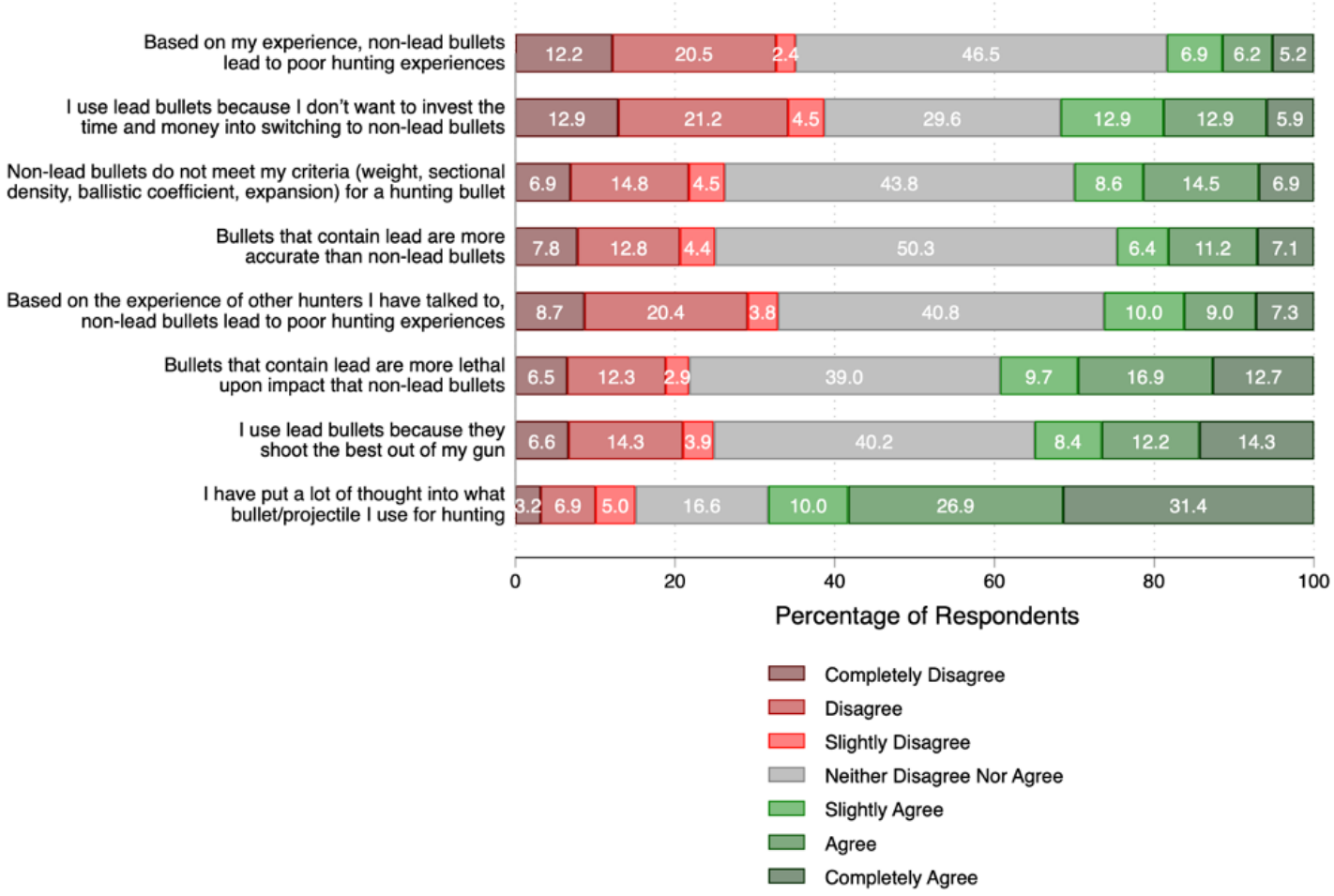


Figure 5. Reasons for not using non-lead ammunition.

Preferred Caliber for Hunting Big Game in the Zion Area

We also asked about hunters' preferred caliber for hunting big game in the Zion area; this was asked of all hunters regardless of whether they had hunted with non-lead or lead ammunition. Preferred calibers are shown in Figure 6. The most popular are .270 (15.8%), .30-06 (14.8%), .50 Muzzleloader (9.0%), and 6.5 Creedmoor (8.4%). This information is valuable, as it could inform a targeted effort to support availability of particular calibers used in the Zion area, which appears to be a major barrier to non-lead ammunition use.

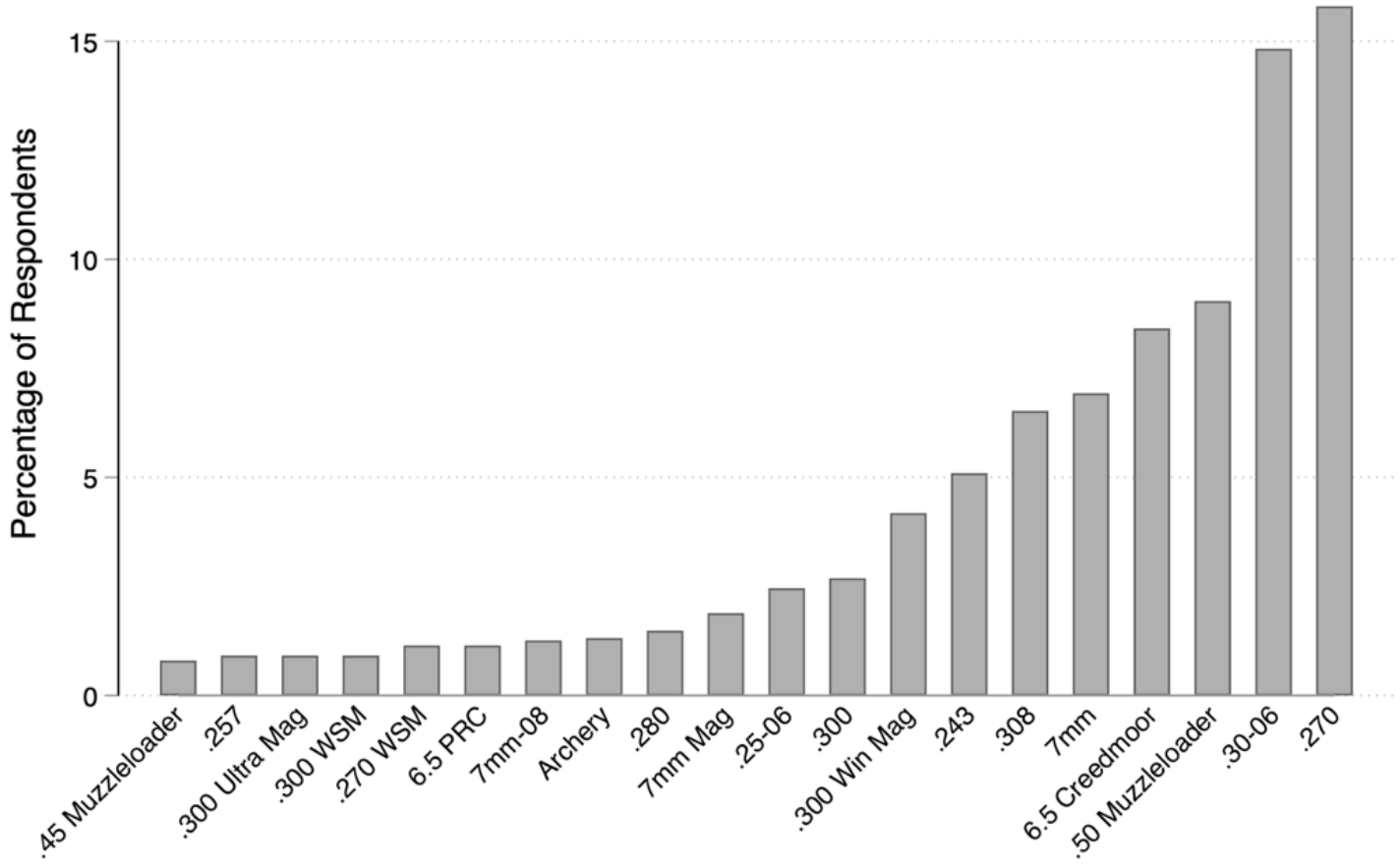


Figure 6. Zion hunters' preferred caliber types.

We also asked about where hunters purchased their ammunition for hunting in the Zion area, and whether they used factory loaded ammunition or reloads made by themselves or others. The primary ammunition source was local retailers, with reloads being the second most common source (Tables 8 & 9). These data show that ammunition reloading is common among Zion hunters. Knowledge of ammunition sources could help inform efforts to impact the non-lead ammunition availability issue.

Table 8

Zion hunters' preferred ammunition sources

Ammunition Source	Frequency	%
A local retailer	562	29.2
I use reloaded ammunition	230	12.0
Ordered online from a national retailer	87	4.5
Other (please specify)	57	3.0
I can't remember	51	2.7
Ordered online from a manufacturer	45	2.3
A local hunting/shooting club	3	0.2

Voucher Program Awareness and Use

Awareness of the DWR voucher program was high, with 89.4% of all respondents indicating they had heard of the program. The program has also been used by most hunters in the region with 60.0% of respondents indicating they have used the program to purchase non-lead ammunition for a big game hunt in the Zion area at some point in the past.

Of those hunters who reported using non-lead ammunition on their most recent hunt within the region, 60.4% indicated they purchased the ammunition with a DWR voucher. Of those who reported using lead ammunition, 68.1% indicated they received a DWR voucher, but were unable to use it to purchase non-lead ammunition due to a supply shortage.

Information Sources

We asked participants about the sources of information they used for hunting gear and hunting opportunities in the Zion area. An understanding of the information sources used by hunters can provide the DWR with valuable information regarding effective outreach methods once communication strategies have been developed.

Information sources used by Zion hunters for hunting gear, including ammunition, are tabulated in Table 10. An important note is that several of our information source options listed in the survey instrument were not selected by any participants. These included:

- Utah Division of Wildlife Resources literature (website, printed materials)
- Gear manufacturers literature (online, catalogs, in-store)
- Hunting specific media (online, magazine, podcast, television shows)
- Mass media (TV, radio, internet news source, newspaper, general interest magazine)
- Federal agency literature (Bureau of Land Management website, Forest Service office)
- Academic literature (scientific journals, university extension reports)

Our survey not only identifies key leverage points regarding targeted content for the desired behavior (use of non-lead ammunition), but also which media should be used for maximum effectiveness. The primary source of gear-related information used by Zion hunters is personal contacts, including friends, family, and other Zion area hunters. Online sources of information were either very small percentages or not used at all.

Table 9

Zion hunters' preferred ammunition load types

Ammunition load type	Frequency	%
Factory loaded	1,056	71.5
Reloads made by myself or others	280	19.0
A combination of factory loaded and reloaded	88	6.0
Unsure	52	3.5

Table 10

Sources used to find information about hunting gear, including ammunition

Source	Frequency	%
Friends and family	909	47.3
Other hunters who have hunted in the area before	385	20.0
Other	129	6.7
Other hunters through online forum or social media	111	5.8
Local outfitters and guides	65	3.4
Utah Division of Wildlife Resources staff	43	2.2
Local hunting/shooting clubs	23	1.2
Total	1,665	100.0

Note. The "Other" option included an open entry text box, which 122 participants used. The major themes of those answers not covered by our options included self/prior experience (n = 65), did not need gear information (n = 11), and various internet sources (n = 6).

We also asked participants what information sources they used for hunting opportunities in the Zion area; the results are tabulated in Table 11. Information related to hunting opportunities was primarily sourced from other Zion hunters (45.1%), but online sources were also used—especially DWR tools, such as their website and online hunt planner.

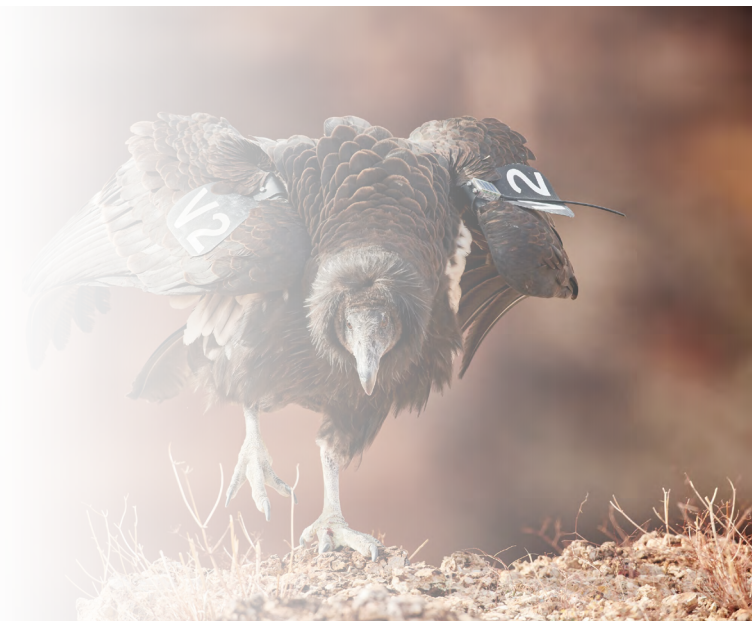
Table 11

Sources used to find information about hunting opportunities in the Zion region

Source	Frequency	%
Other hunters who have hunted in the area before	867	45.1
Utah Division of Wildlife Resources website (other than the hunt planner)	639	33.2
Other	297	15.5
Utah Division of Wildlife Resources hunt planner	243	12.6
Utah Division of Wildlife Resources staff	117	6.1
Other online forum or Facebook page	72	3.7
Local outfitters and guides	67	3.5
Utah Division of Wildlife Resources Facebook/Instagram page	30	1.6
Local hunting/shooting clubs	28	1.5

Note. The "Other" option included an open entry text box. The major themes of those answers not covered by our options included self/prior experience (n = 162), family/friends (n = 54), guide service (n = 15), and other hunting media (n = 13).

Respondents were then asked to rank which of the information sources they found most/least reliable. The choices provided were carried forward from the previous questions. This was a way to filter information sources by those being used by hunters as well as those that are most/least trusted by hunters so the DWR can identify the most effective leverage points for strategic communication efforts. The reliability of each information source is shown in Figure 7.



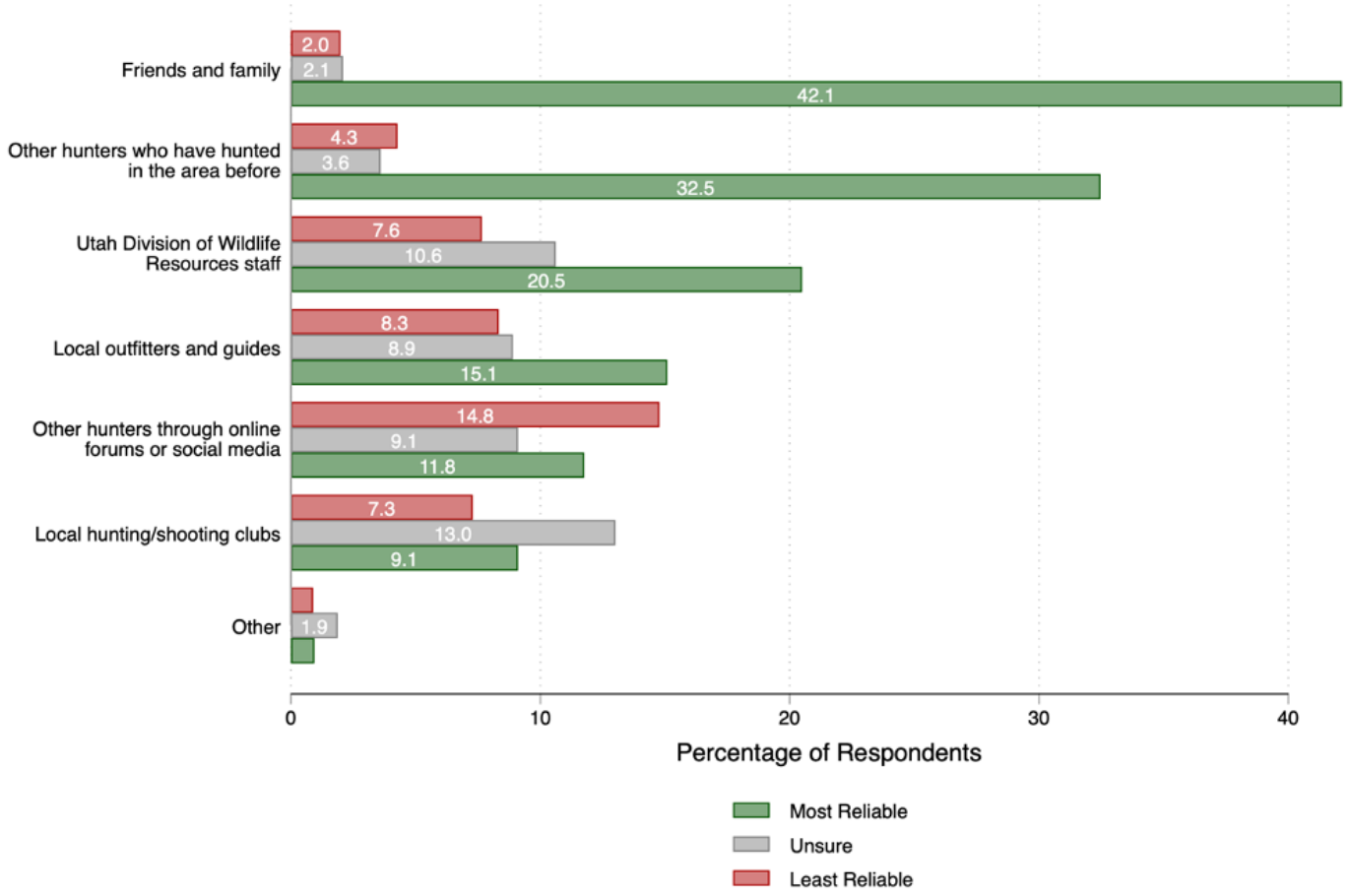


Figure 7. Most/least reliable information sources as reported by Zion hunters.

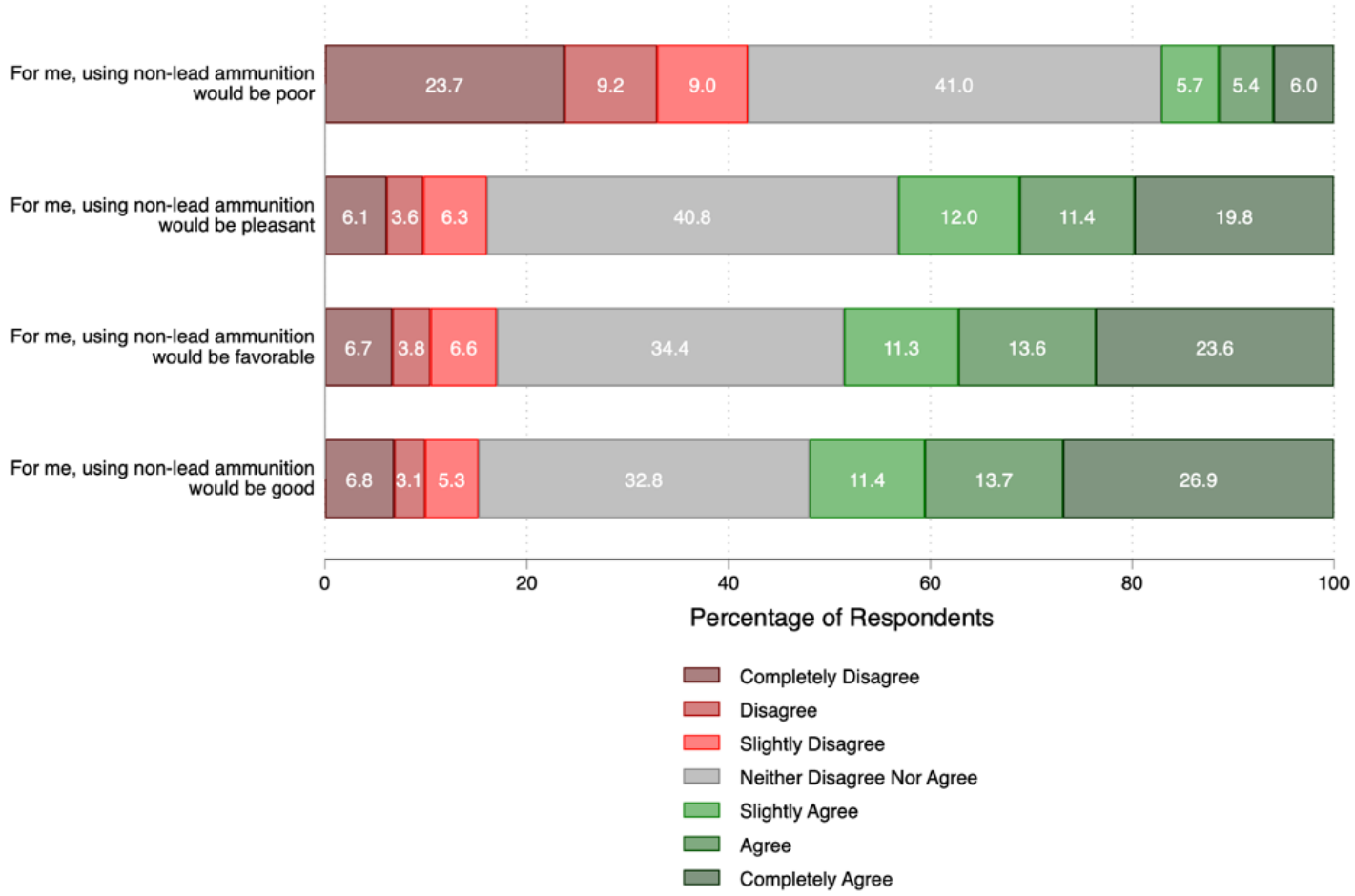


Figure 8. Attitudes towards non-lead ammunition.

Factors Driving Ammunition Choices Amongst Hunters in the Zion Area

The three primary psychological constructs of the TPB are attitudes, subjective norms, and perceived behavioral control. These constructs are believed to predict behavioral intention, which is also measurable, and is itself a predictor of actual behavior. Our measurements of these constructs are described below.

Attitudes towards non-lead ammunition use were positive, with over half of respondents (52.0%) agreeing that using non-lead ammunition would be good (Figure 8). Attitudes are often the primary construct targeted by communication strategies, but strong positive attitudes towards the target behavior could suggest that effective leverage points may be found elsewhere.

Subjective norms were also positive (Figure 9). Just over one-quarter of respondents (25.9%) believe others who are important to them believe they should use non-lead ammunition. Most respondents (79.0%) reported they are aware that the DWR asks them to use non-lead ammunition in the Zion area. Large percentages of respondents chose the neutral response item ("neither disagree nor agree") when asked to rate their level of agreement with the subjective norm statement items. This could potentially be a target construct for communication strategies, especially since personal social circles and other hunters are important information sources (see Tables 10 and 11).

Perceived behavioral control had slightly more negative reports than either the attitudes or subjective norms constructs (Figure 10). Very few respondents were neutral about how easy it is to acquire non-lead ammunition, and over half of respondents (51.6%) disagreed with the statement "acquiring non-lead ammunition is easy." This finding is likely influenced by broader issues such the COVID pandemic and global supply chain issues. While this construct can be targeted by messaging, it seems like the root issue in this context is availability.

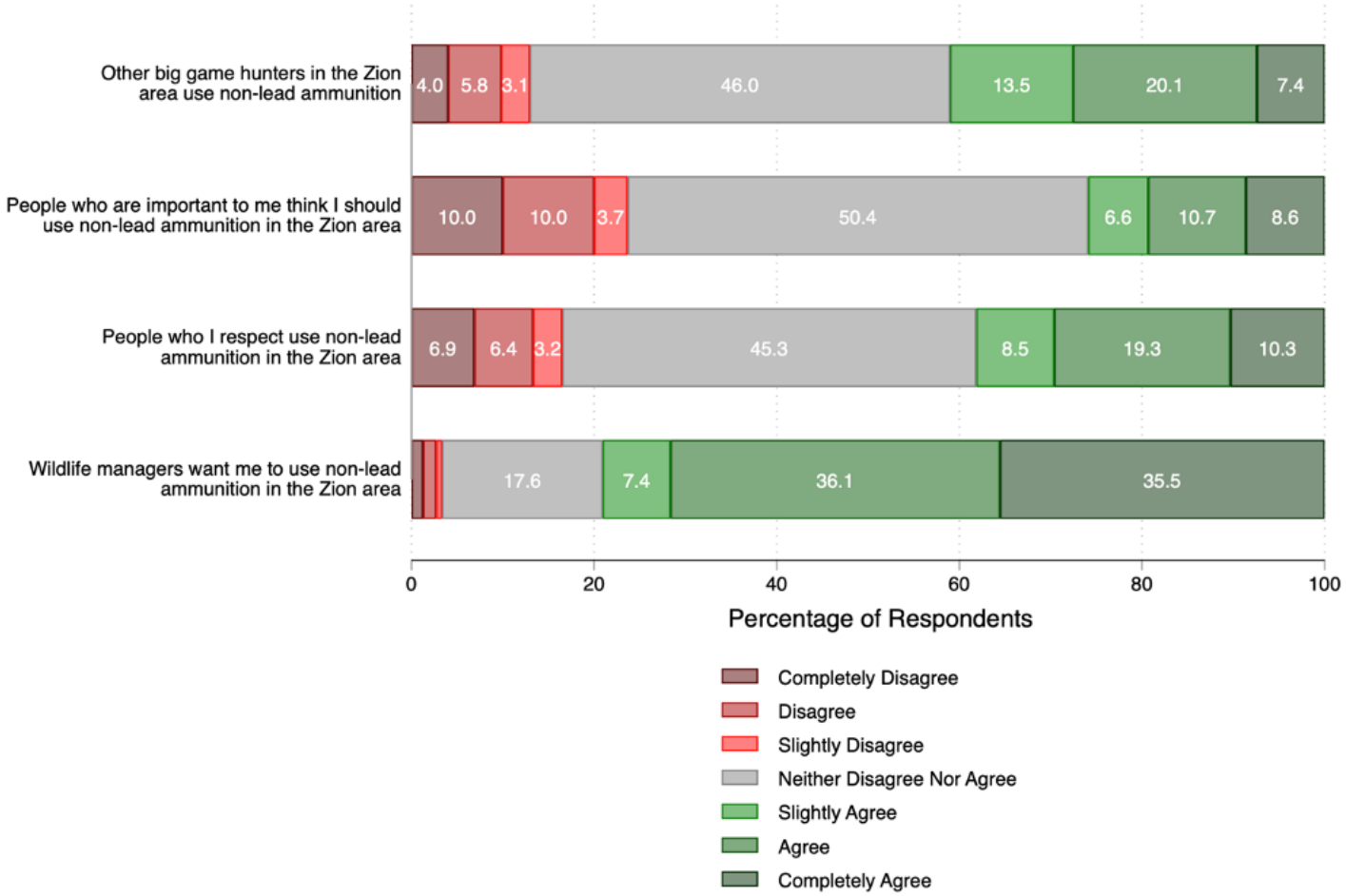


Figure 9. Subjective norms towards non-lead ammunition.

Table 10

Sources used to find information about hunting gear, including ammunition

Source	Frequency	%
Friends and family	909	47.3
Other hunters who have hunted in the area before	385	20.0
Other	129	6.7
Other hunters through online forum or social media	111	5.8
Local outfitters and guides	65	3.4
Utah Division of Wildlife Resources staff	43	2.2
Local hunting/shooting clubs	23	1.2
Total	1,665	100.0

Note. The "Other" option included an open entry text box, which 122 participants used. The major themes of those answers not covered by our options included self/prior experience (n = 65), did not need gear information (n = 11), and various internet sources (n = 6).

Table 11

Sources used to find information about hunting opportunities in the Zion region

Source	Frequency	%
Other hunters who have hunted in the area before	867	45.1
Utah Division of Wildlife Resources website (other than the hunt planner)	639	33.2
Other	297	15.5
Utah Division of Wildlife Resources hunt planner	243	12.6
Utah Division of Wildlife Resources staff	117	6.1
Other online forum or Facebook page	72	3.7
Local outfitters and guides	67	3.5
Utah Division of Wildlife Resources Facebook/Instagram page	30	1.6
Local hunting/shooting clubs	28	1.5

Note. The "Other" option included an open entry text box. The major themes of those answers not covered by our options included self/prior experience (n = 162), family/friends (n = 54), guide service (n = 15), and other hunting media (n = 13).

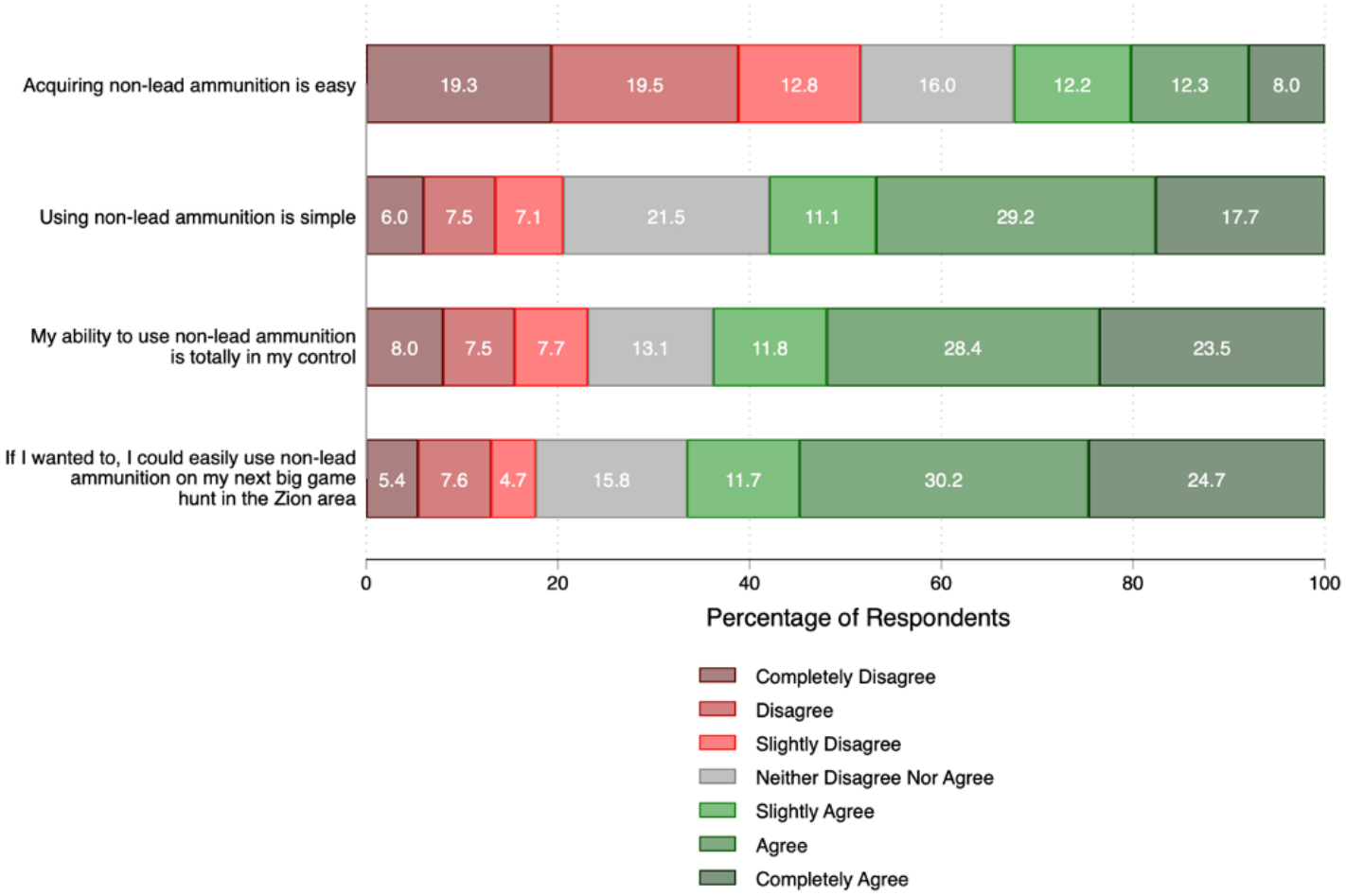


Figure 10. Perceived behavioral control towards non-lead ammunition.

The three constructs above (attitudes, subjective norms, and perceived behavioral control) are the primary constructs of the TPB and have been used to inform communication strategies regarding conservation behavior. While personal norms are not a component of the TPB, literature suggests the theory can be improved with their addition in certain contexts (Ajzen, 1991; Brown et al., 2010; Conner et al., 2003; Conner & Armitage, 1998). If we can demonstrate that hunters in the Zion area hold those norms, they could be important psychological constructs to be targeted by communication strategies (Epps, 2014; Landon et al., 2021).

Data on statements intended to measure personal norms are shown in Figure 11. Respondents did not report strong moral feelings (one type of measurement of personal norms) towards non-lead ammunition use on the first three measurement items, but over half (50.3%) agreed they felt morally obligated to prioritize using non-lead ammunition. Personal feelings of stewardship (another personal norm measure) of the hunting tradition and the landscape on which they hunt were very strong. Both measurements had very high agreement levels (88.4 and 92.7% respectively). Communication strategies could use the strength of these final two items to target the negative or neutral normative beliefs reflected by the first four statement items.

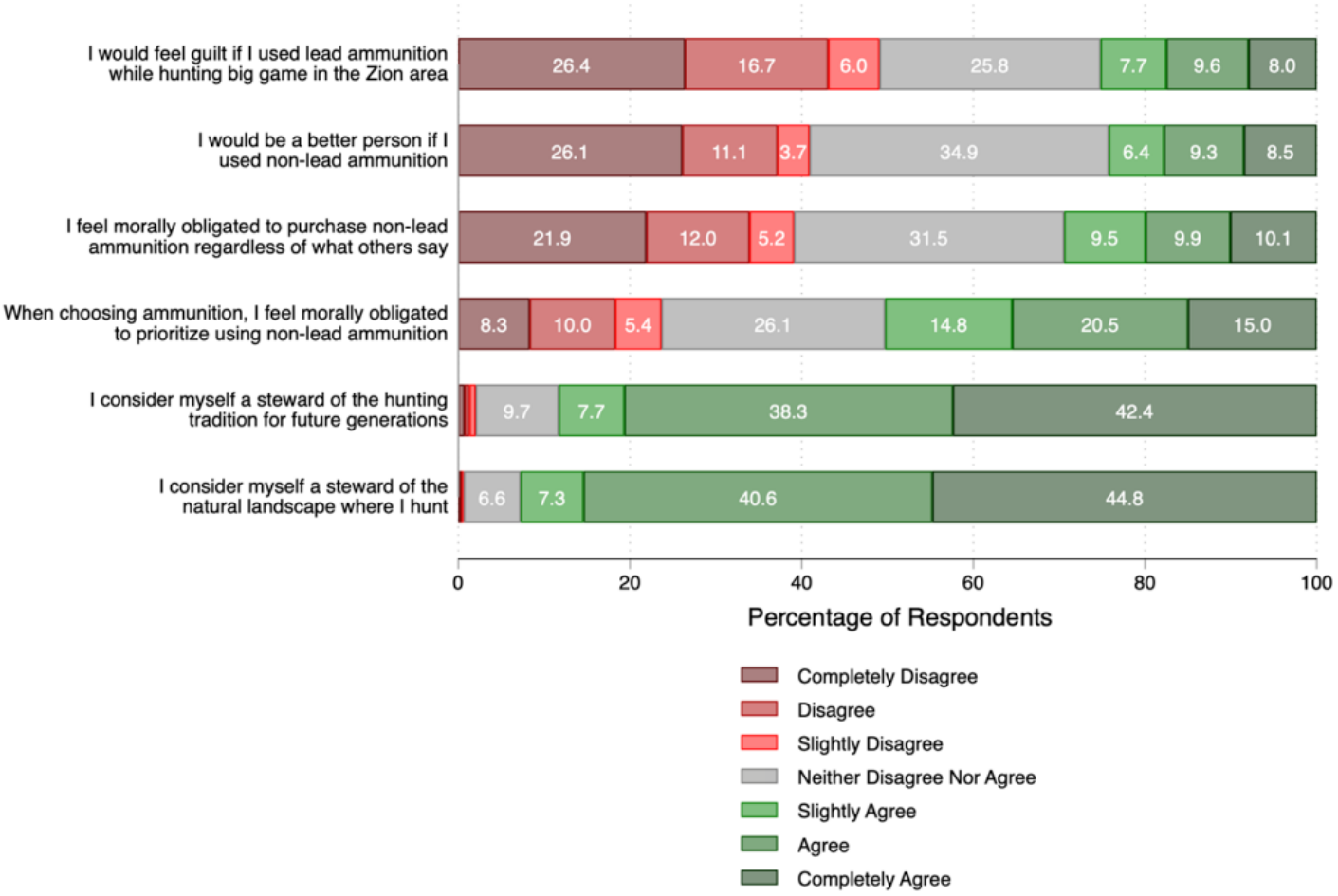


Figure 11. Personal norm towards non-lead ammunition.

Behavioral Intentions

Behavioral intention was the highest overall positive measure within the TPB model, with over half of respondents indicating they either were "determined to" (56.0%), "intend to" (64.2%), or would "try to" (70.9%) use non-lead ammunition on their next hunt in the Zion area (Figure 12). This suggests hunters are aware of the expectation to use non-lead ammunition on their next big game hunt, and have an intention to do so.

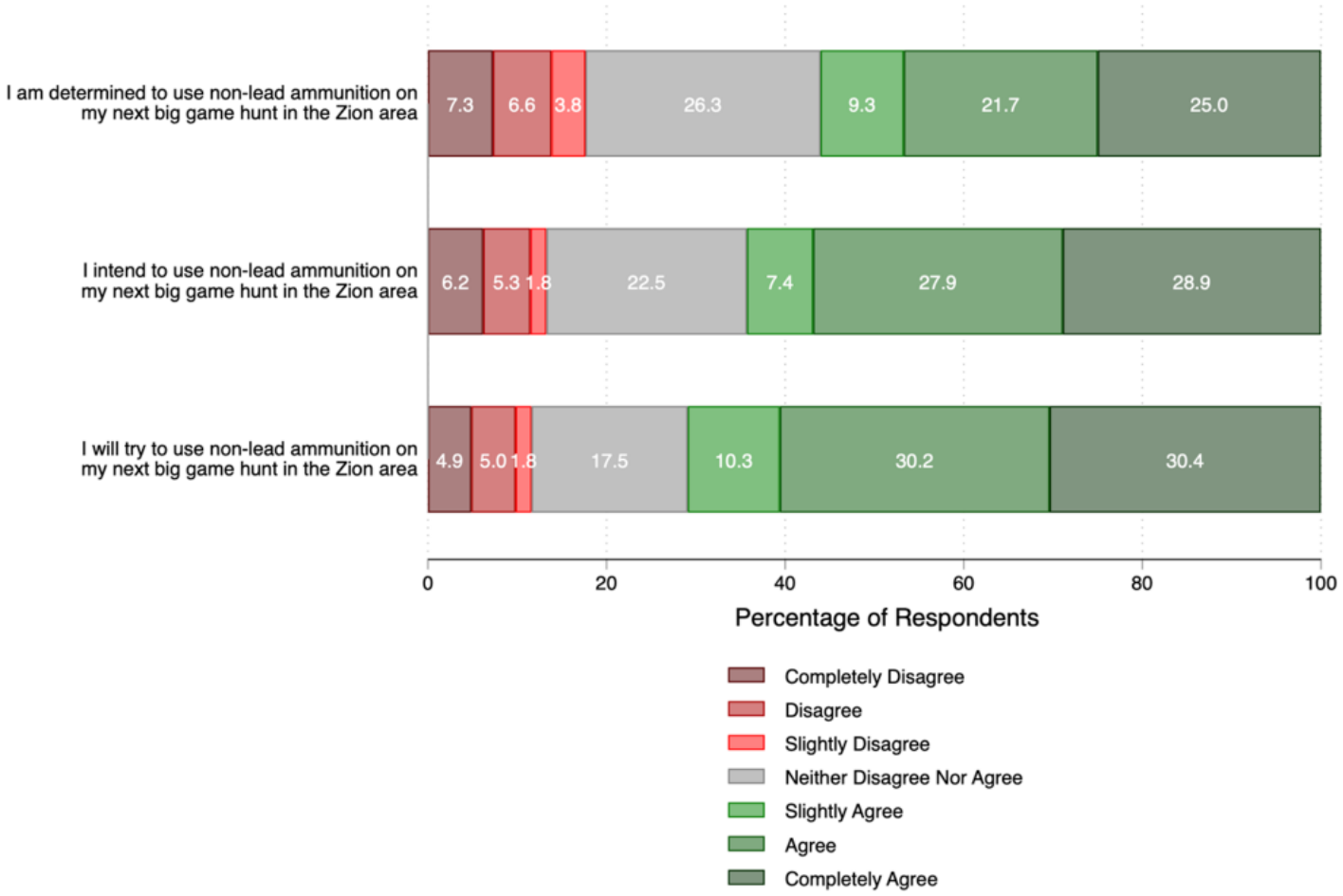


Figure 12. Behavioral intentions towards non-lead ammunition.

Responses to Open-ended Questions on Ammunition Preference

After looking through the open-ended answers to the question, "overall, why do you use lead ammunition when hunting big game in the Zion area?" the reasons given were the same as what we captured with the other items in our survey: accuracy, availability, cost, and lethality were the primary responses.

The open-ended responses to a similarly phrased question asking why hunters used non-lead ammunition when hunting big game in the Zion area, the reasons given were the same as the responses to other questions on the survey: because it was free via the voucher, to minimize contamination of food sources (both human and animal), to conform with the request of DWR, and because its performance was as good or better as a lead alternative.

Communication Strategies Informed by TPB

TPB has been used to inform communication strategies aimed at influencing conservation-specific behavior. Most communication strategies that attempt to influence conservation behavior using TPB target salient beliefs preceding the three primary TPB constructs (attitudes, subjective norms, and perceived behavioral control) (Brown et al., 2010; S. Ham, 2016; Manfredo, 2008; Powell & Ham, 2008). Our research measured the strength of each of these constructs in relation to the use of non-lead ammunition, and the measurement items we used highlight salient beliefs to be targeted by persuasive messaging. For example, 41.0% of respondents agreed with the subjective norm measurement item "Other big game hunters in the Zion area use non-lead ammunition," while only 38.1% agreed with the statement "People who I respect use non-lead ammunition in the Zion area" and even fewer agreed with the statement "People who are important to me think I should use non-lead ammunition in the Zion area" (25.9%). This suggests communication efforts targeting relevant normative beliefs could more effectively impact behavior by using the influence of fellow Zion hunters, as opposed to the influence of those within the hunter's personal social circle.

Another practical example is a comparison of the metrics used to measure perceived behavioral control. Two-thirds (66.6%) of participants responded positively that "If I wanted to, I could easily use non-lead ammunition on my next big game hunt in the Zion area." However, only 32.5% responded positively to the statement "Acquiring non-lead ammunition is easy." This suggests hunters in the Zion area do not see the use of non-lead ammunition as a difficult barrier to overcome, it is the acquisition of non-lead ammunition that is perceived as difficult. These items can focus DWR communication efforts to the salient beliefs that are perceived as barriers to the targeted behavior.

Communication research has recognized that messaging can prove to be persuasive either through a central or peripheral route (Miller et al., 2019). Central route processing requires more effort on the part of the audience but has a stronger effect because it directly impacts the attitude held. Peripheral route processing is a heuristic that uses non-message aspects, such as trust in the message source, feelings associated with the message and its delivery, number of arguments used (regardless of their strength), or the opinion of others regarding the message. Central route processing results in longer lasting effects because it involves evaluation of the merits of the message being communicated and can change underlying beliefs and attitudes. Peripheral route processing can change immediate or short-term behavior, but central route processing is key to long-term behavioral change (Miller et al., 2019).

Communication strategies do not have to target either central or peripheral information processing alone. Simple additions to a persuasive message can use peripheral route processing to reinforce a message targeted at changing an unwanted behavior (i.e., targeting central information processing). Our research suggests the most trusted sources of hunting information are friends/family and other Zion hunters. By framing a message from another Zion hunter (perhaps through a quote or testimonial), peripheral route processing can be elicited. If the message delivered has merit and promotes pro-non-lead ammunition use beliefs and attitudes, both peripheral and central route processing can be utilized simultaneously. An example of this would be soliciting a quote from a lifelong Zion hunter that encourages the preservation of the landscape and its species by using non-lead ammunition and using that quote in outreach materials.

Communication Strategies Informed by Personal Norms

The personal norm construct has been included in research studying pro-environmental behavior because of its influence on altruistic behaviors. This construct consists of beliefs held by an individual regarding whether an action is right or wrong, irrespective of what others think. The addition of the personal norm construct to the TPB framework has improved behavioral predictability in studies examining other altruistic environmental behaviors (Brown et al., 2010). Since hunting is often a solitary activity tied to deeply held personal beliefs and values, the high personal norm metrics reported by the participants in our survey were to be expected. The use of non-lead ammunition can also be characterized as an altruistic behavior, since it is a cost incurred by the hunter, often without perceived direct personal gain or benefit.

The integration of a moral component to the TPB has been seen as particularly relevant to conservation communication in recent years (Brown et al., 2010). The personal norm is a self-imposed sense of moral obligation not captured by the traditional subjective norm component of TPB (Schwartz, 1977), and several

studies have shown that personal norms can increase the predictive power of TPB when altruistic behaviors (such as those that benefit wildlife) are targeted (Conner et al., 2003; Corbett, 2005; Parker et al., 1995; Thøgersen, 2002).

The measures of personal norms we integrated into our survey had high levels of agreement and consequently could be the foundation for effective new communication strategies. A large majority of respondents agreed with our statements regarding personal feelings of stewardship of the hunting tradition (88.4%) and the natural landscape where they hunt (92.7%). The strongest moral norm metric was "When choosing ammunition, I feel morally obligated to prioritize using non-lead ammunition" (50.3% in agreement).

Harland et al. (1999) performed some of the first research examining whether personal norms could be used to better predict pro-environmental behavior; they found it could. This suggests decisions to engage in behaviors that benefit the environment (which would include conservation behaviors) are moral ones, and the addition of personal norms to the TPB model will increase its predictive power. Other research has found "communication campaigns that appeal to people's identity as wildlife stewards can be successful" (Landon et al., 2021, p. 581).

Research on communication using personal norms to effect behavioral change has shown certain factors should be included to maximize effectiveness – the more specific, the better. A message such as "please put trash in the appropriate container" will be more effective than a general one like "please don't litter" (Brown et al., 2010). Temporal proximity to the behavior also increases effectiveness. A message delivered in the immediate time frame prior to the decision to act is most effective (S. H. Ham et al., 2008). A message seeking to influence litter pickup combined all of these factors in a message put on a sign at a trailhead that said,

> "If not you, who? It's the right thing to do. If you see a piece of rubbish along the track that isn't too disgusting, why not pick it up and take it to the bin at the visitor center? This small action not only sets a great example for other visitors, it maintains the natural beauty of the area. Thanks for setting a good example!"

This type of message is a good example of persuasive communication targeting a specific behavior, communicating the message in close proximity to the desired behavior, and targeting personal norms held by the audience. This treatment increased the target behavior from 17.4% in the control group to 36.6% with the personal norm message displayed.

Limitations

One limitation of our survey was its focus on deer hunters. This is the largest hunting group in the Zion area, and the only big game hunting population that draws Zion-specific hunting permits, which are the two primary reasons they were chosen. However, there are other target species in the area whose hunters are more difficult to survey, such as elk (no Zion unit specific tags) and coyote (no permits needed). The hunting of other target species contributes to lead on the landscape and should be investigated through future research.

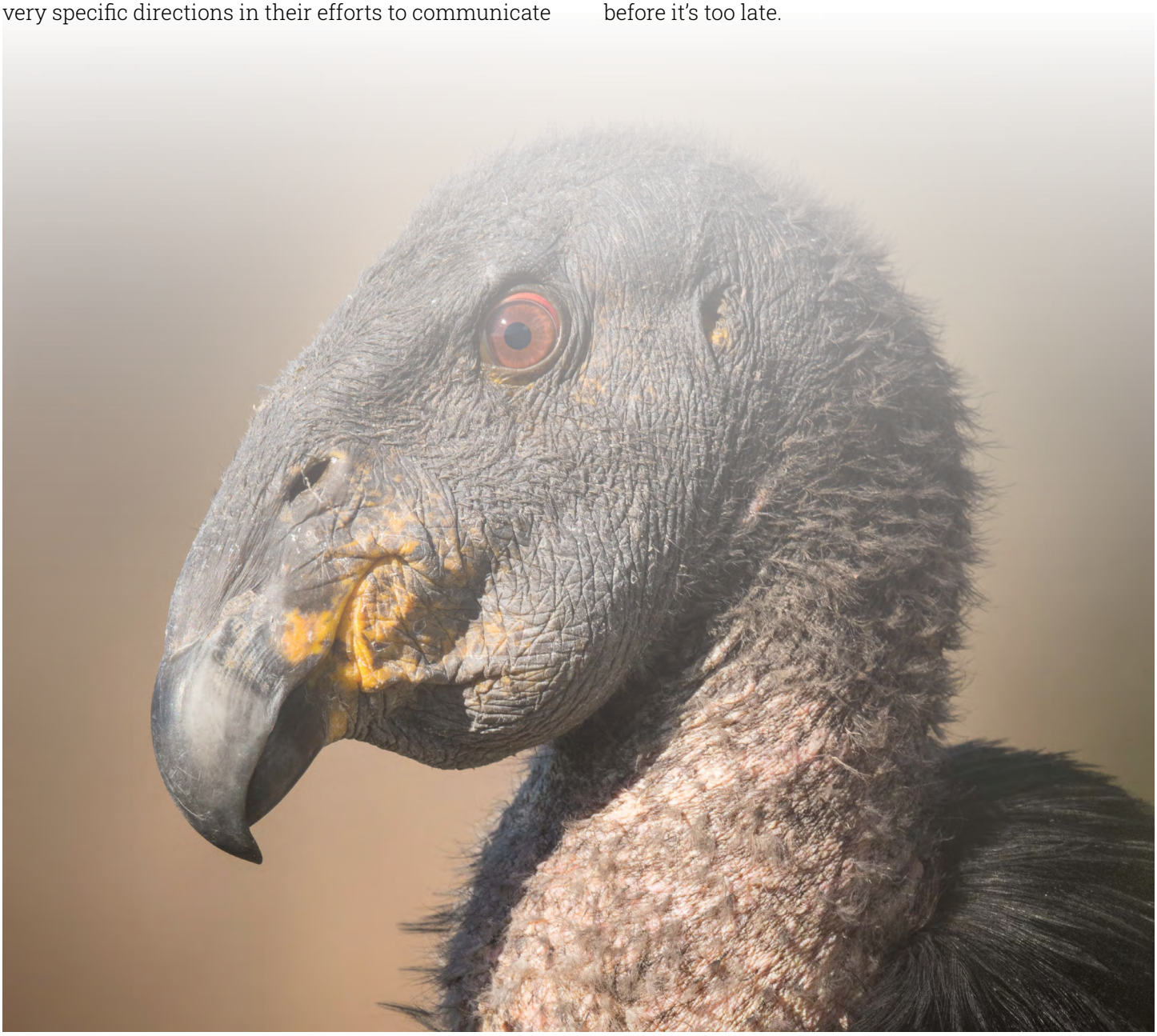
Another limitation of this study was the unique impact that supply chain issues had on non-lead ammunition availability during the study timeframe. The COVID pandemic and other external factors contributed to a unique economic context in which to perform this research. As the above findings suggest, availability was a primary barrier to non-lead ammunition use in the Zion area, and results may have been different if global and local supply chain flows were normal.

Finally, other studies have suggested the COVID pandemic has affected people's outdoor recreation behavior, including consumptive recreation like hunting. Research on outdoor recreation behaviors during the COVID pandemic could be anomalies, but generally seem to align with larger trends.

CONCLUSION

Our study provides numerous pieces of information that can be used in communication and game management efforts in the Zion area. Most deer hunters in the area are using non-lead ammunition, but still not enough to meet the DWR's desired targets. Most hunters are aware of wildlife managers' efforts to encourage the use of non-lead ammunition and a surprisingly large proportion of hunters reported using the DWR's non-lead ammunition voucher program. The continuation of the voucher program is warranted, and will likely be more effective in the future when supply chains return to more normal conditions.

The data reported here can point the DWR in some very specific directions in their efforts to communicate with hunters in the Zion area about the use of non-lead ammunition. Appeals should be made to hunters' strong sense of stewardship over the landscape and the hunting tradition as these are widely held personal norms amongst those who hunt in the area. Appeals should also be made through representations of other hunters who use the area, as they are one of the most trusted groups hunters obtain their information about ammunition. Collectively, these efforts can catalyze a strategic communication plan that taps into the personal characteristics and behaviors that define hunters in the area. Getting lead off the landscape and saving condors can happen, and through the implementation of a strategic communication plan informed by theory and data, we believe it can happen before it's too late.



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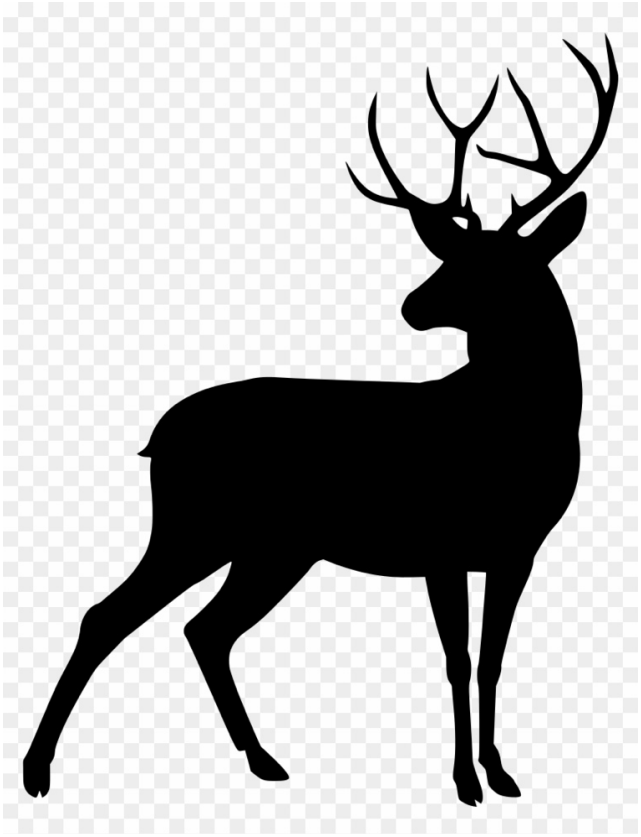
Zion Area Hunters' Attitudes towards Non-Lead Ammunition and Wildlife Conservation

Important Questions for Zion Area Big Game Hunters



All Responses Are Confidential

Thank you for your cooperation in completing this survey!

Study conducted cooperatively by:

UTAH DNR WILDLIFE RESOURCES

INSTITUTE OF OUTDOOR RECREATION AND TOURISM
UTAH STATE UNIVERSITY

2021 Zion Area Hunter Survey

You are invited to participate in a research study by Jordan Smith, Director of the Institute of Outdoor Recreation and Tourism at Utah State University.

The purpose of this research is to inform the Utah Division of Wildlife Resources about hunting behavior, attitudes, and preferences in the Zion area of Utah. Specifically, we are interested in learning about past hunting behavior, ammunition preferences, and hunting information sources used by those who have recently hunted in this area. You are being asked to participate in this research because you have drawn a big game tag for the Zion area in the last 1-5 years.

Your participation in this study is voluntary and anonymous and you may withdraw your participation at any time for any reason. Your name or hunting license number is not requested in the survey and cannot be connected to your survey responses. For your privacy, you can choose when you take the survey, where you take the survey, and what device you take the survey on. **If possible, we recommend taking the survey on a computer instead of a mobile phone, as the formatting is easier to navigate.**

If you take part in this study, you will be asked to participate in the following online survey. Your total estimated participation in this online survey will be approximately 20 minutes.

The possible risks of participating in this study include loss of confidentiality. We cannot guarantee that you will directly benefit from this study, but it has been designed to learn more about the needs and preferences of hunters in Utah, to help managers better communicate with those who participate in hunting in this area.

We will make every effort to ensure that the information you provide remains confidential. We will not reveal your identity in any publications, presentations, or reports resulting from this research study.

We will collect your information through an online survey. Online activities always carry a risk of a data breach, but we will use systems and processes that minimize breach opportunities. This survey data will be securely stored in a restricted-access folder on a secure storage platform at Utah State University.

You can decline to participate in any part of this study for any reason and can end your participation at any time.

If you have any questions about this study, you can contact Jordan Smith at jordan.smith@usu.edu. Thank you again for your time and consideration. If you have any concerns about this study, please contact Utah State University's Human Research Protection Office at (435) 797-0567 or irb@usu.edu. The IRB protocol number for this survey is 11721.

By continuing to the survey you agree that you are 18 years of age or older, and wish to participate. You agree that you understand the risks and benefits of participation, and that you know what you are being asked to do. You also agree that if you have contacted the research team with any questions about your participation and are clear on how to stop your participation in this study if you choose to do so. Please be sure to retain a copy of this form for your records. If you would like a paper copy of this form for your records, please let us know and one will be provided.

Department of Environment and Society | https://qcnr.usu.edu/envs | 5215 Old Main Hill | Logan, UT 84323

I have read the conditions described above, and agree to participate in this survey.

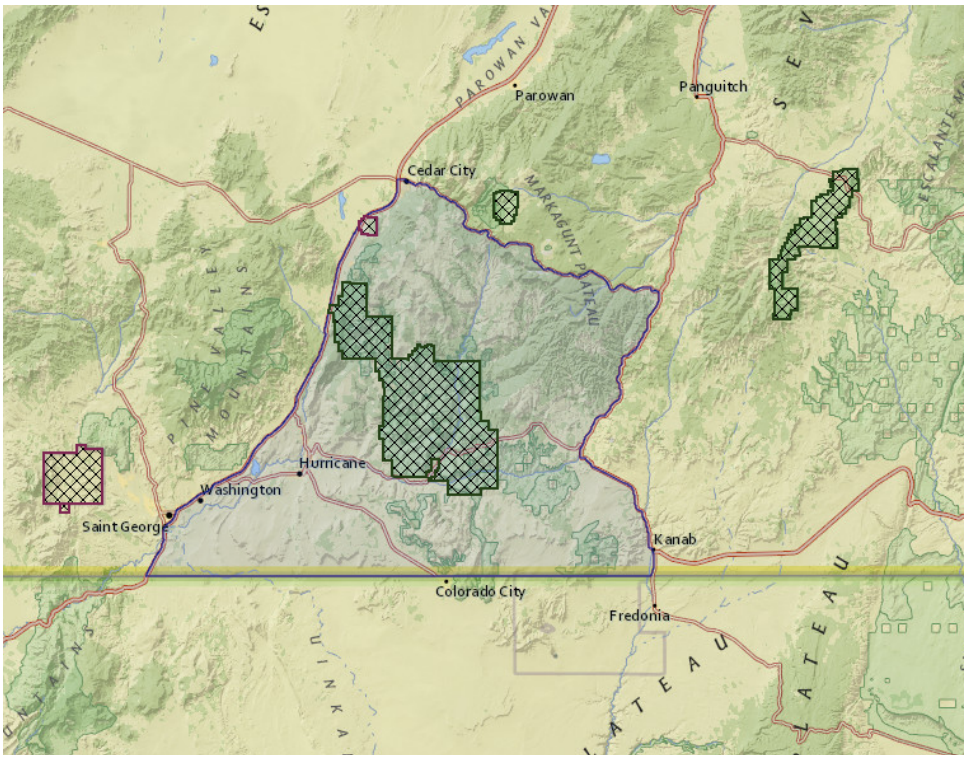
☐ I agree to participate

☐ I disagree and will not participate in this survey

If "I disagree…" is selected, skip to end of survey.

B. Recent Zion Area Big Game Hunting Behavior Section

We would like to begin by asking you a few questions about your most recent hunting experience in the area near Zion National Park. The Zion area is the shaded hunting unit shown on the map below and will be referred to throughout this survey. Please answer the following questions to the best of your ability.



B1. Approximately **how many days** have you hunted in the Zion area in the last 12 months? (Enter '0' if you did not hunt the Zion area in the last 12 months) _____ (*open ended numeric response)*

B2. **What type of game did you hunt** in the Zion are in the last 12 months? (Please check all that apply)

- ☐ Deer
- ☐ Elk
- ☐ Pronghorn
- ☐ Bighorn sheep
- ☐ Black bear
- ☐ Cougar
- ☐ Upland game birds or wild turkey
- ☐ Migratory game birds, waterfowl, or crow
- ☐ Other (please specify) _____

B3(a). [For each type of game]: Approximately **how many days** did you hunt for each of your target game species in the last 12 months?
_____ (*open ended numeric response for each selection from previous question)*

B3(b). Approximately **how many of each species** did you harvest in the last 12 months?
_____ (*open ended numeric response)*

In this survey we will be asking you questions about ***bullets used for big game hunting that do and do not contain lead****. The picture below shows the difference between the two. (Top is a hunting bullet that contains lead. Bottom is a hunting bullet that does not contain lead).*

B4. What is **your preferred caliber** for hunting big game in the Zion area? (*For example, .308, 12 gauge, .30-06, etc.)*
_____ (*open ended numeric response)*

B5. What **type of ammunition** did you use on your most recent big game hunt in the Zion area?

- ☐ Lead
- ☐ Non-lead
- ☐ Unsure/prefer not to answer

(IF "Lead" is selected in B4, present the following question.)

B5(a). Did you **intend to use non-lead ammunition** for your last big game hunt in the Zion area but were unable to due to a shortage of ammunition in your preferred caliber?

- ☐ Yes
- ☐ No
- ☐ Unsure/Prefer not to answer

B6. **What type of ammunition material do you prefer** to hunt with in the Zion region?

- ☐ Lead
- ☐ Non-lead
- ☐ Unsure/Prefer not to answer

B7. Are you **aware of the voucher program** from the Utah Division of Wildlife Resources to help hunters purchase non-lead ammunition for big-game hunts in the Zion area?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

(IF "Non-lead" is selected in B4, present the following question.)

B8. Was the non-lead ammunition used for your last big game hunt in the Zion area **purchased with a voucher** from the Utah Division of Wildlife Resources?

- ☐ Yes
- ☐ No
- ☐ Unsure/Prefer not to answer

(IF "Lead" is selected in B4, present the following question.)

B9. **Did you receive a voucher** from the Utah Division of Wildlife Resources to purchase non-lead ammunition for your last big game hunt in the Zion area but were unable to purchase any due to a shortage of ammunition in your preferred caliber?

- ☐ Yes
- ☐ No
- ☐ Unsure/Prefer not to answer

B10. Have you ever used a voucher from the Utah Division of Wildlife Resources to purchase non-lead ammunition for a big game hunt in the Zion area?

- ☐ Yes
- ☐ No
- ☐ Unsure/Prefer not to answer

B11. Could you briefly explain why you do or do not use lead ammunition?

C. Information/Ammunition Selection Section

C1. Approximately how many years have you hunted? (This is a cumulative, lifetime total)
_____ (*open ended numeric response)*

C2. Prior to your most recent hunt in the Zion area, **where did you go to find information about hunting opportunities** in the region?

- ☐ Utah Division of Wildlife Resources staff
- ☐ Utah Division of Wildlife Resources hunt planner
- ☐ Utah Division of Wildlife Resources website (other than the hunt planner)
- ☐ Utah Division of Wildlife Resources Facebook/Instagram page
- ☐ Other hunters who have hunted in the area before
- ☐ Other online forum or Facebook page
- ☐ Local outfitters and guides
- ☐ Local hunting/shooting clubs
- ☐ Other (*please specify*): _____

C3. Prior to your most recent hunt in the Zion area, **where did you go to find information about hunting gear**, including ammunition?

- ☐ Utah Division of Wildlife Resources staff
- ☐ Utah Division of Wildlife Resources (website, printed materials)
- ☐ Gear manufacturers literature (online, catalogs, in-store)
- ☐ Hunting specific media (magazine, podcast, television shows)
- ☐ Mass media (TV, radio, internet news source, newspaper, general interest magazine)
- ☐ Academic literature (scientific journals, university extension reports)
- ☐ Friends and family
- ☐ Other hunters who have hunted in the area before
- ☐ Other hunters through online forum or social media
- ☐ Federal agency literature (Bureau of Land Management website, Forest Service office)
- ☐ Local outfitters and guides
- ☐ Local hunting/shooting clubs
- ☐ Other (*please specify*): _____

C4. Which of the following information sources do you feel are the **most/least reliable** regarding hunting gear, including ammunition? (You do not need to rank all the choices.)

Carry forward list of selected choices from previous questions, with option to classify them as "most reliable" or "least reliable."

C5. **Where did you purchase the ammunition** that you used prior to your most recent hunt in the Zion area?

- ☐ A national retailer (e.g., Cabela's, The Sportsman's Warehouse, Wal-Mart, etc.)
- ☐ A local retailer
- ☐ Ordered online from a national retailer
- ☐ Ordered online from a manufacturer
- ☐ A local hunting/shooting club
- ☐ I use reloaded ammunition
- ☐ I can't remember
- ☐ Other (*please specify*): _____

C6. **How important are each of the following factors to you** when you are making decisions about purchasing ammunition to hunt in the Zion area? *(Please check all that apply).*

	Not important at all	Slightly Important	Moderately Important	Very Important	Extremely Important
Convenience *(the ammunition is easy to get)*	1	2	3	4	5
Quality *(the ammunition meets your performance standards)*	1	2	3	4	5
Price *(the ammunition is priced affordably)*	1	2	3	4	5
Material *(you have a preference for the material used in the ammunition)*	1	2	3	4	5
Some other factor *(please specify):*_____	1	2	3	4	5

C7. For your most recent hunt in the Zion region, **what type of ammunition loads did you use**?

- ☐ Factory loaded ammunition (off-the-shelf, mail order)
- ☐ Reloads made by myself or others
- ☐ A combination of factory loaded ammunition and reloaded
- ☐ Unsure

D. Historical Non-Lead Ammunition Use Section

D1. **Have you ever used non-lead ammunition** while hunting in the Zion area of Utah?

- ☐ Yes
- ☐ No
- ☐ Unsure

IF YES, present the following questions. If NO, skip to D9.

D2. When I have used non-lead ammunition, I used it with my (check all that apply):

- ☐ Shotgun (slugs)
- ☐ Shotgun (shot)
- ☐ Muzzleloader
- ☐ Handgun
- ☐ Rifle

D3. Have you harvested game in the Zion unit with non-lead ammunition?

☐ Yes ☐ No

IF YES, present the following question:

D5(a). How many of each species have you harvested with non-lead ammunition?

Species harvested	***Number Harvested***
Deer	
Elk	
Pronghorn	
Desert/Rocky Mountain Bighorn Sheep	
Mountain Goat	
Bison	
Moose	
Black Bear	
Cougar	
Coyotes (or other non-game species)	

D4. In your experience hunting big game, please rank the following statements:

	Completely disagree	**Disagree**	**Slightly disagree**	**Neither disagree nor agree**	**Slightly agree**	**Agree**	**Completely agree**
Non-lead ammunition is just as lethal for killing game as lead ammunition.	-3	-2	-1	0	1	2	3
Non-lead ammunition is just as accurate as lead ammunition.	-3	-2	-1	0	1	2	3
Non-lead ammunition is just as available as lead ammunition.	-3	-2	-1	0	1	2	3
I don't mind paying more for non-lead ammunition.	-3	-2	-1	0	1	2	3
I prefer to use non-lead ammunition over lead ammunition.	-3	-2	-1	0	1	2	3

D5. What are your main reasons for using non-lead ammunition?

	Completely disagree	**Disagree**	**Slightly disagree**	**Neither disagree nor agree**	**Slightly agree**	**Agree**	**Completely agree**
I use non-lead ammunition because I don't want to expose	-3	-2	-1	0	1	2	3

myself or my family to lead.							
I use non-lead ammunition because it is more lethal for killing game than lead ammunition.	-3	-2	-1	0	1	2	3
I use non-lead ammunition because it is more accurate than lead ammunition.	-3	-2	-1	0	1	2	3
I use non-lead ammunition because I do not want to harm other wildlife species (eagles, hawks, condors, etc.) from lead poisoning.	-3	-2	-1	0	1	2	3
I use non-lead ammunition because it is what I have available.	-3	-2	-1	0	1	2	3

D6. Overall, what is the main reason (or reasons) you chose to use non-lead ammunition when hunting big game species?

IF answer to D1 is NO, present the following question:

D7. We want to learn more about why you choose to use lead ammunition. Please tell us how much you agree or disagree with the following statements:

	Completely disagree	Disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Agree	Completely agree
I have put a lot of thought into what bullet/projectile I use for hunting.	-3	-2	-1	0	1	2	3
Bullets that contain lead are more lethal upon impact that non-lead bullets.	-3	-2	-1	0	1	2	3
Bullets that contain lead are more accurate that non-lead bullets.	-3	-2	-1	0	1	2	3
Non-lead bullets do not meet my criteria (weight, sectional density, ballistic coefficient, expansion) for a hunting bullet.	-3	-2	-1	0	1	2	3
I have heard stories about poor bullet performance from people I trust who have use non-lead bullets.	-3	-2	-1	0	1	2	3
I have had poor hunting experiences using non-lead bullets.	-3	-2	-1	0	1	2	3
I have tried non-lead bullets.	-3	-2	-1	0	1	2	3
I use lead bullets because they shoot the best out of my gun.	-3	-2	-1	0	1	2	3
I use lead bullets because I don't want to invest the time and money into switching to non-lead bullets.	-3	-2	-1	0	1	2	3

D8. Overall, what is the main reason (or reasons) you chose to use lean over non-lead ammunition when hunting big game species?

E. Perceptions About Using Non-Lead Ammunition Section

E1. How much do you disagree or agree with the following statements?

	Completely disagree	Disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Agree	Completely agree
I intend to use non-lead ammunition on my next big game hunt in the Zion area of Utah.	-3	-2	-1	0	1	2	3
I will try to use non-lead ammunition on my next big game hunt in the Zion area of Utah.	-3	-2	-1	0	1	2	3
I am determined to use non-lead ammunition on my next big game hunt in the Zion area of Utah.	-3	-2	-1	0	1	2	3

E2. For each of the characteristics listed below, please rate your feelings about using non-lead ammunition while hunting in the Zion area. "For me, using non-lead ammunition would be..."

Not pleasant at all	-3	-2	-1	Neutral 0	-1	+2	+3	Extremely pleasant
Not at all good	-3	-2	-1	Neutral 0	-1	+2	+3	Extremely good
Not at all favorable	-3	-2	-1	Neutral 0	-1	+2	+3	Extremely favorable
Not at all poor	-3	-2	-1	Neutral 0	-1	+2	+3	Extremely poor

E3. How much do you disagree or agree with the following statements? (If you haven't discussed this with others, please take your best guess.)

Statement	Completely disagree	Disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Agree	Completely agree
People who I respect use non-lead ammunition in the Zion area.	-3	-2	-1	0	1	2	3
People important to me think I should use non-lead ammunition in the Zion area.	-3	-2	-1	0	1	2	3
Other big game hunters in the Zion area use non-lead ammunition.	-3	-2	-1	0	1	2	3
Wildlife managers want me to use non-lead ammunition in the Zion area	-3	-2	-1	0	1	2	3
If I wanted to, I could easily use non-lead ammunition on my next big game hunt in the Zion area.	-3	-2	-1	0	1	2	3
Acquiring non-lead ammunition is easy.	-3	-2	-1	0	1	2	3
Using non-lead ammunition is simple.	-3	-2	-1	0	1	2	3
My ability to use non-lead ammunition is totally in my control.	-3	-2	-1	0	1	2	3

E4. How much do you disagree or agree with the following statements?

	Completely disagree	Somewhat Disagree	Slightly disagree	Neutral	Slightly agree	Somewhat Agree	Completely agree
I consider myself a steward of the hunting tradition for future generations.	-3	-2	-1	0	1	2	3
I consider myself a steward of the natural landscape where I hunt.	-3	-2	-1	0	1	2	3
When choosing ammunition, I feel morally obligated to prioritize using non-lead ammunition.	-3	-2	-1	0	1	2	3
I would be a better person if I used non-lead ammunition.	-3	-2	-1	0	1	2	3
I feel morally obligated to purchase non-lead ammunition regardless of what others say.	-3	-2	-1	0	1	2	3
I would feel guilt if I used lead ammunition while hunting big game in the Zion area.	-3	-2	-1	0	1	2	3

E5. How much do you disagree or agree with the following statements?

	Completely disagree	Disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Agree	Completely agree
I identify strongly with the Zion area	-3	-2	-1	0	1	2	3
I get more satisfaction out of hunting in the Zion area than from hunting other areas	-3	-2	-1	0	1	2	3
I wouldn't substitute any other area for doing the type of hunting I do in the Zion area	-3	-2	-1	0	1	2	3
If I hunt in other areas, the experience would be the same	-3	-2	-1	0	1	2	3
The Zion area means a lot to me	-3	-2	-1	0	1	2	3

F. Sociodemographics Section

Finally, we would like to ask you a few questions about yourself

F1. What year were you born? _____

F2. What was your annual household income in 2020?

- ☐ $0 - $19,999
- ☐ $20,000 - $39,999
- ☐ $40,000 - $59,999
- ☐ $60,000 - $79,999
- ☐ $80,000 - $99,999
- ☐ $100,000 - $149,999
- ☐ $150,000 - $199,999
- ☐ $200,000+
- ☐ Prefer not to answer

F3. What is your current state of residence?

Insert US state abbreviation

If previous question contains "ut" display following question:
How many years have you lived in Utah?

F4. What is the zip code of your current residence?

F5. Please select your gender:

☐ Female
☐ Male
☐ I prefer to self describe:
_____
☐ Prefer not to answer

F6. Please use the space below to provide any other comments that would help the Division of Wildlife Resources in their efforts to improve hunting experiences in the Zion area.

Thank you for taking the time to complete this survey! Your responses will be used by the Division of Wildlife Resources in their ongoing efforts to manage wildlife and provide high-quality hunting opportunities in the Zion area.

If you have any other questions or comments, please reach out to Dr. Jordan Smith (jordan.smith@usu.edu) and Dr. Russ Norvell (russellnorvell@utah.gov).

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