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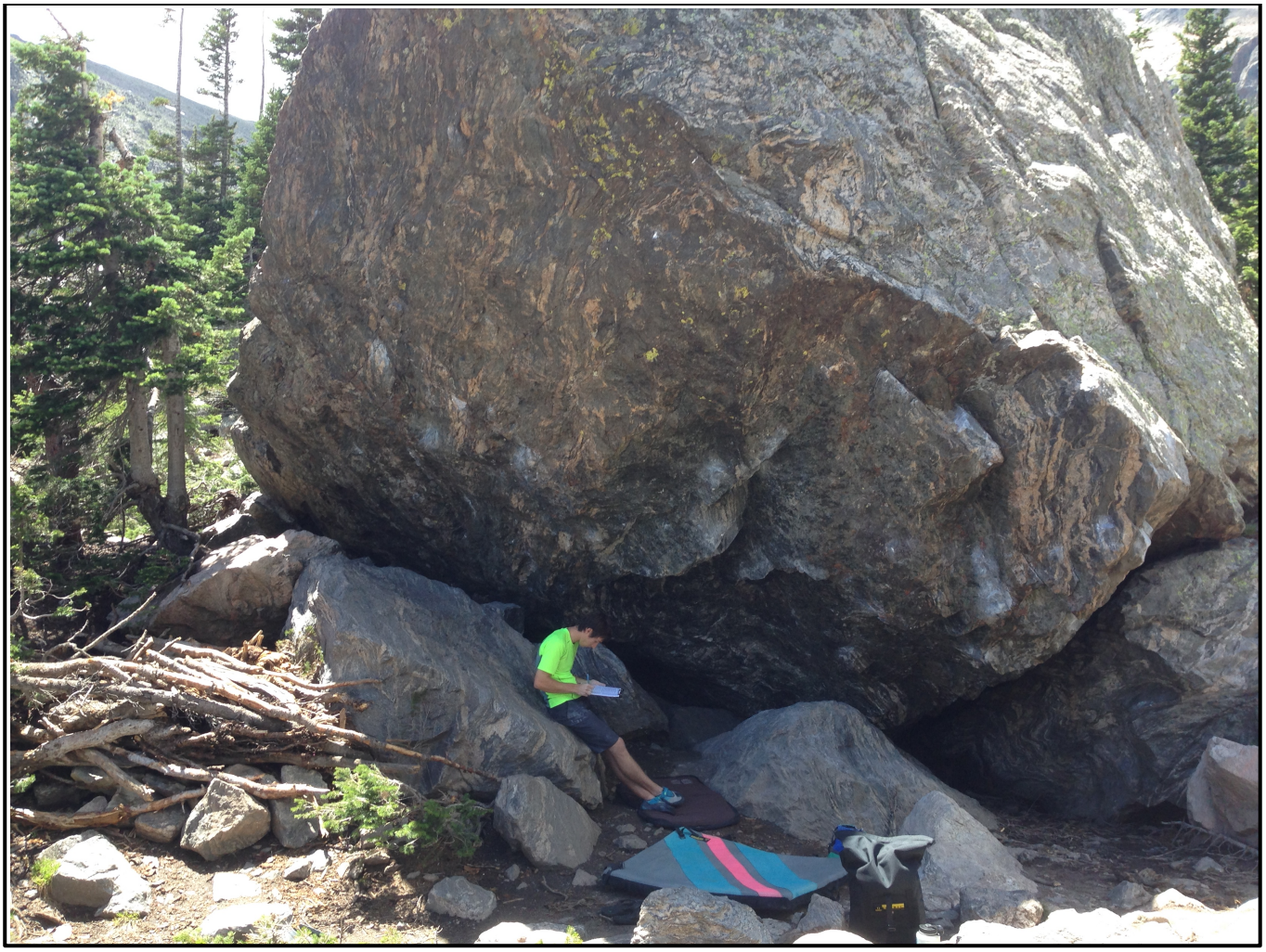
Boulderers' perceptions of Leave No Trace in Rocky Mountain National Park

Improving resource conditions and visitor experiences

Natural Resource Report NPS/RMNP/NRR—2016/XXX



ON THIS PAGE
Photograph of researchers assessing study sites in Chaos Canyon.
Photograph courtesy of Derrick Taff

ON THE COVER
Photograph of study participant completing a survey beneath a popular bouldering route in Chaos Canyon
Photograph courtesy of Forrest Schwartz

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Improving resource conditions and visitor experiences

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November 2016

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Taff, B. D. and Schwartz, F. G. 2016. Boulderers' perceptions of Leave No Trace in Rocky Mountain National Park: Improving resource conditions and visitor experiences. Natural Resource Report NPS/XXXX/NRR—2014/XXX. National Park Service, Fort Collins, Colorado.

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Executive Summary

Participation in bouldering has increased substantially over the past two decades. Of the 7.5 million estimated rock climbers in 2013, nearly two-thirds of those were considered to be boulderers and/or indoor gym climbers. As bouldering continues to gain in popularity and participation, more climbing opportunities are being discovered outdoors within both public and private lands. Rocky Mountain National Park (RMNP), for example, has been a popular climbing destination since the 1800s and is often considered a mecca for boulderers around the world (NPS, 2001). Park managers are beginning to document the increase of bouldering and have raised questions regarding the potential for associated environmental and social resource impacts. While the RMNP management plan allows for all modes of climbing (see NPS, 2001), there exists no estimate of baseline conditions (e.g. how much bouldering exists in the park, potential user group conflicts, ecological damage related to bouldering activity). Moreover, there is little to no understanding of the environmental and social practices of boulderers, and their attitudes toward such practices.

The purpose of this study was to develop a baseline understanding of who is bouldering at RMNP and their attitudes, perceptions, and beliefs, regarding Leave No Trace recommended practices. The insights gleaned from this research can inform the development of effective communication and education strategies that serve to improve resource conditions and visitor experiences.

Researchers from Pennsylvania State University, in collaboration with Rocky Mountain National Park, conducted an on-site visitor survey of bouldering activity in the Bear Lake corridor of the park. Data collection occurred over a 21-day period from July 10-31, 2015 using a stratified representative sampling approach. A total of 229 completed surveys were collected, yielding an overall response rate of 95%.

Results indicate that, on a global level, boulderers were highly supportive of Leave No Trace and corresponding behaviors, suggesting that expansion of messaging and outreach specific to bouldering, in conjunction with the continued educational strategies currently promoted by the Leave No Trace Center and RMNP, could influence attitudes in a manner that better aligns with wilderness management objectives. Overall, they reported positive perceptions of Leave No Trace and felt it is an important means of minimizing recreation-related impacts. However, attitudes toward some bouldering specific behaviors were less favorable and merit additional attention. For example, *Moving rocks or trees at the base of a boulder to develop a safer landing zone* and the act of *Removing lichen, moss, or plants from a boulder to establish a new route* (a practice commonly referred to as "gardening") received greater support relative to the other Leave No Trace practices being evaluated. These identified attitudinal gaps between bouldering practices and Leave No Trace recommendations, which advocate no or minimal site alterations, highlight opportunities to develop collaborative solutions for mitigating potentially impactful behaviors related to bouldering in the park.

Research such as this provides insight to effective communication approaches to engage and educate this group in order to develop best messaging practices. Study results suggest there is need to develop a "standard" set of minimum impact bouldering principles. The Leave No Trace Center for Outdoor

Ethics along with other stakeholder groups are currently in the process of developing these messages and materials (B. Lawhon, personal communication, May 26, 2016). Education and messaging efforts are being initiated in RMNP via signage, website, and direct ranger and park volunteer contact. Park staff has also begun, and continue, to collaborate with external agencies and constituent groups in outreach efforts. Of note, nearly 70% of respondents in this study indicated they first learned to climb indoors in a gym. This research confirms the priority for park staff to focus education and outreach efforts within the climbing gym industry. An important implication for wilderness stewardship is that the bouldering population tends to be composed primarily of a younger generation of users. It is important to not alienate this group of wilderness users but instead work with this community to help foster interest in wilderness protection amongst a new generation of wilderness stewards. Finally, these results provide baseline data regarding attitudes toward Leave No Trace behaviors, which perhaps after the implementation of additional education strategies specific to bouldering behaviors, can be monitored over time in conjunction with ecological conditions, to assess trends related to this growing wilderness activity.

Acknowledgments

The authors would like to thank Dr. David Pettebone, Paul McLaughlin, Scott Esser, the RMNP climbing rangers, the Leave No Trace Center's Ben Lawhon and Faith Overall, and the bouldering community for their support of this research project.

Introduction

Rock climbing in general is a growing sport among recreationists. The Outdoor Industry Association (2013) reports that nearly 7.5 million people participated in some form of rock climbing in 2013, a 5% increase over the past three years. Various forms of outdoor rock climbing exist, including: traditional, sport, and ice climbing, mountaineering, and bouldering. The focus of this research is on bouldering exclusively, which is commonly defined as "the practice of climbing small rock formations or boulders that are short enough in height that ropes and gear are not necessary" (The Access Fund, 2006).

Participation in bouldering has increased substantially over the past two decades. Of the 7.5 million estimated rock climbers in 2013, nearly two-thirds of those were considered to be boulderers and/or indoor gym climbers (Outdoor Industry Association, 2013). The growing popularity of bouldering has been attributed to the low cost of entry, accessibility, and mainstream publicity. Moreover, an increase in dedicated climbing gyms and fitness center climbing walls, the growth of youth climbing programs, indoor climbing competitions, and an increasing market of magazines, companies, products, and events have all contributed to the rapid growth of the sport. For most climbers, their experience with the sport begins in the gym and then progresses to climbing outdoors.

As bouldering continues to gain in popularity and participation, more climbing opportunities are being discovered outdoors within both public and private lands. Over the last decade, Rocky Mountain National Park (RMNP) has become an iconic bouldering destination, particularly in the Emerald Lake and Chaos Canyon areas. In 2011 a bouldering guidebook was published, increasing awareness and visitation to the park's vast bouldering resources, uniquely set within the stunning yet fragile alpine wilderness found within RMNP.

Like all outdoor recreation activities, bouldering has the potential to cause ecological degradation, such as vegetation loss, soil erosion, and resource modification; social impacts, such as user conflicts, crowding, and increased anthropogenic noise; and aesthetic impacts associated with residual climbing chalk on boulders. Park managers are beginning to document the increase of bouldering in the Park and have raised questions of the associated environmental and social resource impacts. This is of particular concern in the wilderness environment where bouldering takes place in RMNP.

While the RMNP management plan allows for all modes of climbing (see NPS, 2001), there exists no estimate of baseline conditions (e.g. how much bouldering exists in the park, potential user group conflicts, ecological damage related to bouldering activity). Furthermore, there is little to no understanding of the environmental and social practices of boulderers, and their attitudes toward such practices.

Indirect management in the form of education is frequently applied to minimize ecological and social impacts in wilderness areas (Manning, 2003). Leave No Trace has been adopted nationally by the federal land agencies as well as by many state and urban parks, and internationally. Thus, Leave No Trace, as prescribed by the Leave No Trace Center for Outdoor Ethics, is the most prevalent

minimum impact education strategy applied in parks and protected areas (Marion, 2014), with the end-goal of sustaining or improving resource and social conditions. Visitor perceptions (i.e., visitor attitudes, beliefs and awareness) of Leave No Trace can lead to either appropriate or inappropriate behaviors, depending on understanding and perspective. Therefore, it is difficult to achieve management objectives without understanding visitor attitudes and behaviors, and in particular, perceptions of Leave No Trace. Though RMNP has dedicated efforts toward protecting resources and social conditions through implementation of Leave No Trace-focused educational campaigns, it is unknown how boulderers – a growing user-group in the park – perceive these programs or whether current strategies are relevant for this user-group or effective at influencing their Leave No Trace behavioral intentions.

Over the years the principles of Leave No Trace have been adapted to address existing and emerging outdoor recreation use patterns. These adaptations have addressed specific activities, such as fishing and llama packing; as well as recreation settings and contexts, such as the Appalachian Trail, winter recreation, and international travel. The emergence of outdoor bouldering introduces a new pattern of recreation use in parks and protected areas (e.g. the use of crash pads and climbing chalk, accessing areas typically not visited by other recreationists), calling for a need to examine the extent to which commonly practiced outdoor bouldering behavior aligns with Leave No Trace recommended practices.

Previous research suggests attitudes to be an important driver of human behavior (Ajzen, 1985; 1991). The Theory of Planned Behavior (TPB) is one of the most commonly applied theories in studies of human behavior (Ajzen, 2011). Briefly, the TPB suggests that attitudes, along with beliefs, norms, and behavioral control, influence behavioral intent, and ultimately behavior (Ajzen, 1985; 1991). Based on this premise, researchers have provided evidence that to effectively change human behavior, efforts be directed at individuals' attitudes, or the belief structures underlying those attitudes (Ajzen, 1991; Fishbein & Ajzen, 2005).

Understanding visitor attitudes and perceptions allows for the development of specifically tailored intervention campaigns that can improve resource protection and visitor experiences, while simultaneously minimizing financial burdens associated with directly enforcing management objectives and repairing/rehabilitating damaged resources. If appropriately implemented, bouldering specific Leave No Trace practices can reduce ecological and social impacts and improve visitor experiences by influencing behaviors.

This study aims to develop a baseline understanding of who is bouldering at RMNP and their attitudes, perceptions and beliefs regarding Leave No Trace recommended practices. It also intends to explore differences between those who learned to climb indoors and those who learned outdoors, as well as differences by skill level. The insights gleaned from this research can inform the development of effective communication and education strategies that serve to improve resource conditions and visitor experiences. The following research questions will be examined in order to explore the issues identified above:

1. What are boulderers' perceptions of Leave No Trace recommended practices in RMNP?

2. What are the influences of attitudes, perceived effectiveness, perceived difficulty, subjective norms, and self-reported knowledge on future Leave No Trace behavioral intent in RMNP?

3. Do boulderers who learned to climb indoors differ from those who learned outdoors in regards to their knowledge and perceptions of Leave No Trace recommended practices?

4. Do differences exist between novice and advanced (self-reported) boulderers in regards to their knowledge and perceptions of Leave No Trace recommended practices?

Methods

This section describes the research design and methods applied in the development and implementation of the study. This study consisted of an on-site survey of boulderers at two locations in the Chaos Canyon area of the Bear Lake corridor.

Key informant interviews

To inform this on-site study, we first conducted semi-structured interviews (Bernard, 2013) with stakeholders, professionals, managers and others involved with bouldering activities in RMNP. The key informant interviews achieved three main goals: 1) to develop a general impression of the bouldering community at large; 2) to develop a general impression of those involved with bouldering activities at RMNP specifically; and 3) to aid in the development of the on-site survey instrument.

Interviews were conducted via telephone during January 2015, and were recorded upon receiving permission from the respondent. Key informants were identified through purposive and snowball sampling methods (Bernard, 2013). That is, we began by contacting a short list of known central figures in the local and national bouldering community. To generate a larger list of prospective informants we asked individuals in this initial group if they would be willing to recommend someone with substantial knowledge of the bouldering community. A total of nine individuals participated in the interviews. These individuals included contextual experts such as a bouldering guide book author, local climbing gym managers, a RMNP climbing ranger, staff at the Access Fund, and professional climbers that frequent the area. These interviews served to inform the development of the on-site methods and structure and content of the survey instrument.

On-site visitor survey

This study involved the use of an on-site survey of boulderers at RMNP. The survey instrument was developed based on results of the key informant interviews and also includes adaptations of Leave No Trace-related items that have been used in previous studies (see Lawhon et al., 2013; Taff et al., 2014; Vagias & Powell, 2010). The on-site survey fulfills three primary purposes: 1) to measure ROMO boulderers attitudes, perceptions, beliefs, knowledge, and awareness of LNT recommended practices; 2) to build a basic demographic profile of boulderers at ROMO; and 3) to explore potential barriers to engaging in recommended Leave No Trace practices.

Site and Sample

The on-site survey of boulderers was conducted during July, 2015 at two areas within RMNP: Emerald Lake and Lake Haiyaha, which have been identified by park managers as the most popular

bouldering destinations within the park (McDonald, 2011). Located in the Bear Lake corridor of RMNP, Emerald Lake and Lake Haiyaha are known in the international climbing community as premiere bouldering destinations due to the vast numbers of glacially deposited boulders and the serene natural environment. While, in general, fewer visitors access the Chaos Canyon than other parts of the park, dedicated boulderers are commonly found there and are diverse in style, ability, and origin (McDonald, 2011).

Data collection occurred over a 21-day period from July 10-31, 2015 using a stratified representative sampling approach. Sampling was stratified by weekday and weekend at Chaos Canyon across 17 sampling periods, and at Emerald Lake through 15 sampling periods, each spanning from 10 a.m. to 5 p.m. Within each stratum respondents were selected to participate in the survey using a purposive sampling method as used in previous climbing studies (Monz, 2009; Schuster, Thompson, & Hammitt, 2001). During each sampling period researchers traveled the survey sites on foot to look for individuals and groups bouldering. All individuals and groups observed bouldering were approached using a standard introductory script and asked if they would be willing to participate in the study. Surveys were completed on-site and completed by a single individual over the age of 18. When parties of two or more were encountered, all individuals, age 18 or older were invited to complete a survey. Each distinct/exclusive group or individual encountered was assigned a unique identifying number, which was recorded on the survey, allowing us to check for intragroup homogeneity of survey responses. No significant similarities were found, thus all surveys were evaluated at the individual level.

Survey Instrument

The constructs to be measured by the survey were guided largely by the Theory of Planned Behavior (TPB) framework (Ajzen, 1991). The specific items and question wording were adapted from previous LNT research (Lawhon et al., 2013; Taff et al., 2014; Vagias & Powell, 2010), and reworded minimally to reflect bouldering specific behavior and knowledge items. TPB constructs measured in the survey included: behavioral intent to perform recommended LNT practices, attitudes toward LNT recommended practices, perceived effectiveness of LNT recommended practices, perceived behavioral control (perceived difficulty) of LNT recommended practices, and self-reported knowledge of Leave No Trace. Additional items collected information regarding respondents' experience use history, place attachment/identity, climbing background, and basic demographics (age, gender, place of residence). Surveys were administered on paper and completed with pen or pencil. Survey length was two double-side pages and took approximately 8-10 minutes to complete. The survey was submitted and approved by the Federal Office of Management and Budget (OMB) for application in RMNP under the approval number OMB Control # 1024-0224, for expiration on 8-31-2015 (see Appendix A for example survey).

Item Measurement

Attitudes were measured through several batteries of questions that examined perceived *appropriateness*, *effectiveness*, and *difficulty* associated with practicing Leave No Trace-related behaviors. The attitudinal batteries included items related to the seven Leave No Trace Principles generally, and additional items related to bouldering specifically. Many of the items related to the

seven Leave No Trace Principles have been used in previous research (see Lawhon et al., 2013; Taff et al., 2014; Vagias & Powell, 2010; Vagias et al., 2014).

To measure attitudes toward the *appropriateness* of specific Leave No Trace recommended practices, respondents were presented 13 Likert-type statements anchored from 1= Very Inappropriate to 7 = Very Appropriate (e.g. *Moving rocks, trees, or shrubs at the base of boulders to develop safer landing zones*) that correspond to recommended Leave No Trace practices, and asked to indicate how appropriate or inappropriate each behavior is for boulderers to engage in while at RMNP. All of these statements are considered inappropriate behaviors under strict interpretation of Leave No Trace. The perceived *effectiveness* of Leave No Trace practices in minimizing impact in RMNP was assessed through 16-Likert type behavior statements asking respondents to indicate the extent to which each behavior reduces impacts (e.g. *Placing gear & crash pads on durable surfaces).* These items were rated on a seven-point scale anchored from 1 = Never Effective to 7 = Effective Every Time. Perceived *difficulty* of practicing the same 16 behaviors as in the *effectiveness* battery was assessed on a seven-point scale anchored from 1 = Very Difficult to 7 = Very Easy. Global perceptions of Leave No Trace as a program were evaluated by seven Likert-type items anchored from 1= Strongly Disagree to 7 = Strongly Agree (see Figure 1). The global perception questions were located toward the end of the survey to eliminate potential bias associated with using the phrase "Leave No Trace" in any of the attitudinal batteries that preceded these items.

Additional survey items measured perceptions of bouldering-related impacts, familiarity and knowledge of Leave No Trace practices and outdoor bouldering ethics, place attachment and resource specificity, and crowding and displacement. To evaluate perceptions of bouldering-related social and environmental impacts in the park respondents were provided a list of potential conditions (e.g. *Excessive social trails leading to bouldering sites*) and asked to indicate whether they perceived the condition as *Not a Problem*, a *Minor Problem, Moderate Problem*, or a *Major Problem* within the park. Familiarity with outdoor bouldering ethics was measured as a dichotomous Yes or No response, and self-reported knowledge of Leave No Trace practices was measured using a six-point Likert-type item anchored from 0 = No Knowledge to 6 = Expert. Five items were included to evaluate the level of place attachment and resource specificity that respondents associate with RMNP (e.g. *Rocky Mountain National Park means a lot to me*; *Bouldering in Rocky Mountain National Park is more important to me than bouldering in any other place*). These items were measured with a Likert-type scale anchored from 1 = Strongly Disagree to 7 = Strongly Agree. Crowding and displacement were evaluated with four items. Respondents were asked to indicate how the number of other boulderers encountered compared to their expectations, how crowded they felt while bouldering, how the number of other boulderers effected their overall experience, and whether they moved to a different location based on the number of people encountered.

Data Analysis

All data analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) software, version 22. Survey data was initially entered into an Excel spreadsheet and then imported into an SPSS database for analysis. Univariate and bivariate descriptive statistics were conducted first to identify outliers and missing data. Missing data was coded as 999 and responses that were

unclear or illegible were coded with 888. Surveys that were less than 75% complete were deleted from the dataset. Independent samples t-tests were conducted to check for differences by location (i.e., Emerald Lake and Lake Haiyaha). No statistically significant differences were found, thus locations were combined and analyzed in aggregate.

In order to address the first and second research questions, descriptive statistics were used to paint a picture of boulderers at RMNP, in terms of who they are and what their attitudes and beliefs are related to Leave No Trace recommended practices. Descriptive statistics were used to create a demographic profile of respondents to gain a better understanding of who is bouldering at RMNP, including information such as: gender, age, and home zip code. A frequency analysis, including means and standard deviations, of responses to the attitude, knowledge and global belief statements was used to identify the level of agreement in the sample across the individual Leave No Trace recommended practice statements.

In addressing research questions three and four, we grouped respondents by self-reported bouldering ability and the place where they learned to boulder (indoor or outdoor). Self-reported ability, initially measured as a four-category variable (Beginner, Intermediate, Advanced, Expert) was recoded to create a dichotomous variable (Novice or Advanced). Responses to these two items were then recoded to sort respondents into one of four categories: Indoor Novice, Indoor Advanced, Outdoor Novice, Outdoor Advanced. We then conducted analysis of variance (ANOVA) with Tukey's post hoc tests to examine differences in responses across these categories.

Results

This chapter provides overall results of on-site survey data analysis. The first section reports descriptive statistics for each survey question. The second section reports results related to differences in respondent groups.

Descriptive Results

Survey Response

A total of 111 bouldering parties were approached for participation in the study yielding 227 completed surveys: 126 at Lake Haiyaha and 101 at Emerald Lake. The overall response rate was 95%, with a 91% response rate at Lake Haiyaha and a 98% response rate at Emerald Lake (Table 1). No non-response bias was found at either location.

Table 1. Survey response rate.

	Study Site		
	Lake Haiyaha	**Emerald Lake**	**Total**
Groups Contacted	58	53	111
Declined	5	1	6
Accepted	53	52	105
Response Rate	95%	98%	95%
Surveys Completed	126	101	227

Sample Characteristics

Approximately 72% of the sample was male (Table 2).

Table 2. Self-reported gender.

Gender	***N***	***Percent***
Female	64	28
Male	162	72

The average age of the total sample was 27, with a median of 25 and standard deviation of 6.24 years (Table 3).

Table 3. Age of respondents.

Mean	***Median***	***Mode***	***SD***
27	26	25	6.24

More than 96% of respondents were US residents (Table 4).

Table 4. Country of residence.

Country of Origin	***N***	***Percent***
United States	220	97
Other*	6	3
*Other countries represented included: Canada, Norway, and Switzerland		

Approximately 65% (N = 133) of US residents reported to be residents of the state of Colorado (Figure 1).

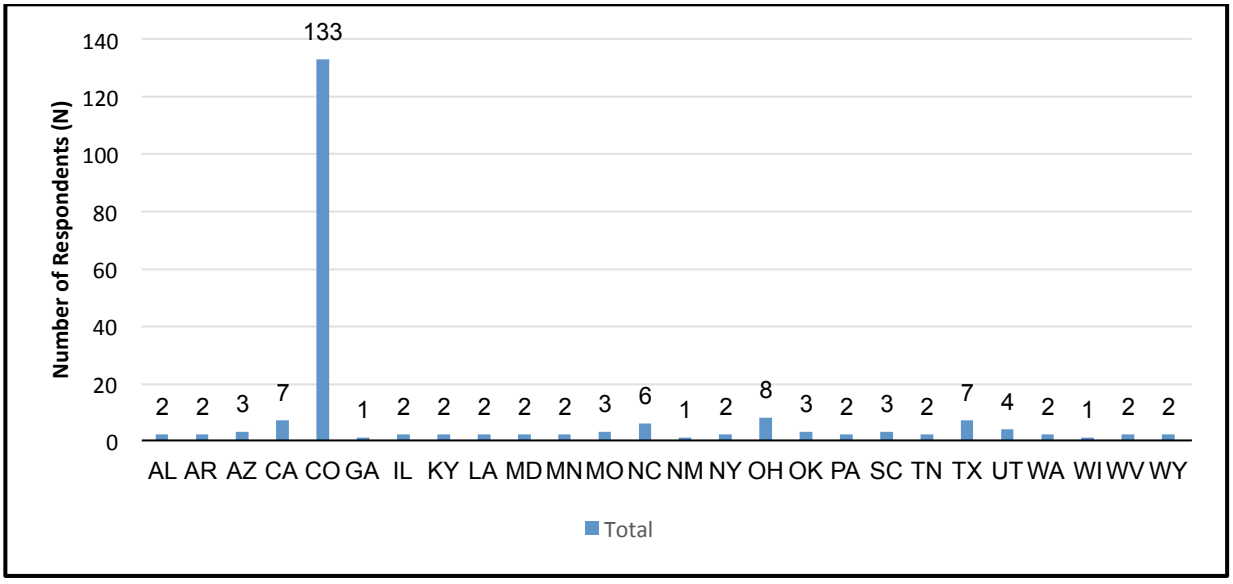

Figure 1. Respondents' state of residence.

Of the Colorado residents, the majority resided in the front range cities of Boulder, Denver, and Fort Collins. (Figure 2).

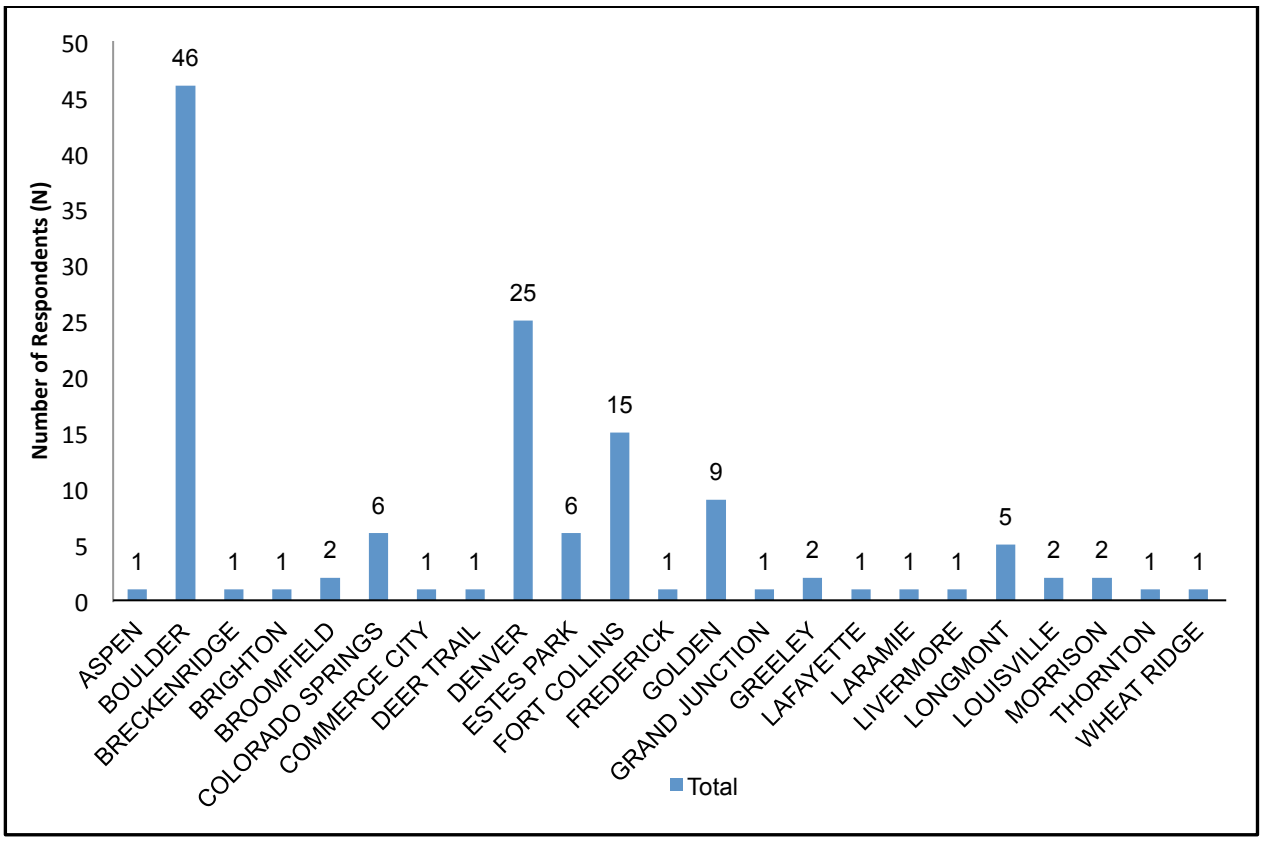

Figure 2. City of residence for Colorado residents.

77% of bouldering parties consisted of two to four people, and the overall mean group size was three (Table 5).

Table 5. Observed group size.

# People in Group	*N*	*Percent*
1	17	8
2	75	33
3	60	27
4	38	17
5	8	4
6	13	6
7	6	3
8	8	4

Bouldering background and experience

On average, respondents reported approximately seven years of previous bouldering experience in general, and approximately two and half years of bouldering experience at RMNP specifically. Nearly 30% of respondents were bouldering in RMNP for the first time, just under 50% had been

bouldering in RMNP for one year or less, and on average, 2011 was the year in which respondents first visited RMNP (Table 6).

Table 6. Previous bouldering experience.

Question	*N*	*Mean*	*Median*	*Mode*
How many years have you been bouldering?	229	6.9	5	5
How many years have you been bouldering at Rocky Mountain National Park?	218	2.5	2	1
In what year did you first visit Rocky Mountain National Park?	226	2011	2013	2015

Greater than 62% of the sample reported to be of advanced to expert bouldering ability (based on the commonly used "Hueco V-scale" bouldering route grading standards) (Table 7).

Table 7. Self-reported bouldering ability.

Category	*N*	*Percent*
Beginner (V0-V2)	19	9
Intermediate (V3-V5)	65	29
Advanced (V6-V9)	106	47
Expert (V10-V15)	34	15

When asked where they initially learned to climb, 67% of respondents reported to have learned indoors in a gym, while 33% learned outdoors (Table 8).

Table 8. Setting where respondents first learned to climb.

Where did you learn to climb?	*N*	*Percent*
Indoors at a rock gym	145	67
Outdoors	72	33

Informal instruction by friends was found to be the most common approach to learning how to boulder, as 67% of respondents reported to have learned in this way (Table 9).

Table 9. Mode of climbing instruction.

Who taught you to climb?	*N*	*Percent*
Family members (informally)	17	8
Friends (informally)	146	67
Climbing club (informally)	15	7
Took a course from University/College (formal instruction)	7	3
Took a course from outfitter/guide (formal instruction)	8	4
Other	24	11

Perhaps not surprisingly, the majority (74%) of respondents reported un-roped climbing (bouldering) to be their predominant style of climbing (Table 10).

Table 10. Predominant climbing style.

What type of climber are you predominately?	*N*	*Percent*
Roped (Sport, Traditional, etc.)	57	26
Un-roped (Boulderer)	160	74

Given the options of gyms, frontcountry (road-side crags, easy/short approaches), or backcountry (i.e. remote areas, long approaches), half of respondents indicated front country areas as their preferred location for bouldering, followed by backcountry (45%) and gyms (5%) (Table 11).

Table 11. Preferred bouldering location.

Preferred bouldering location	*N*	*Percent*
Gyms	11	5
Frontcountry (road-side crags, easy/short approaches)	107	50
Backcountry (i.e. remote areas, long approaches)	95	45

Chaos Canyon was reported to be the bouldering area in RMNP where respondents typically spend most of their time (71%), followed by Emerald Lake (24%) (Table 12).

Table 12. Bouldering areas in RMNP where respondents typically spend most of their time.

Bouldering area in RMNP	*N*	*Percent*
Chaos Canyon	146	71
Wild Basin	1	1
Endo Valley	0	0
Emerald Lake	49	24
Elkland	0	0
Other	9	4

Respondents were asked to indicate which specific bouldering problem they spent the most time on during the day they completed the survey. These results are illustrated below in Figure 3.

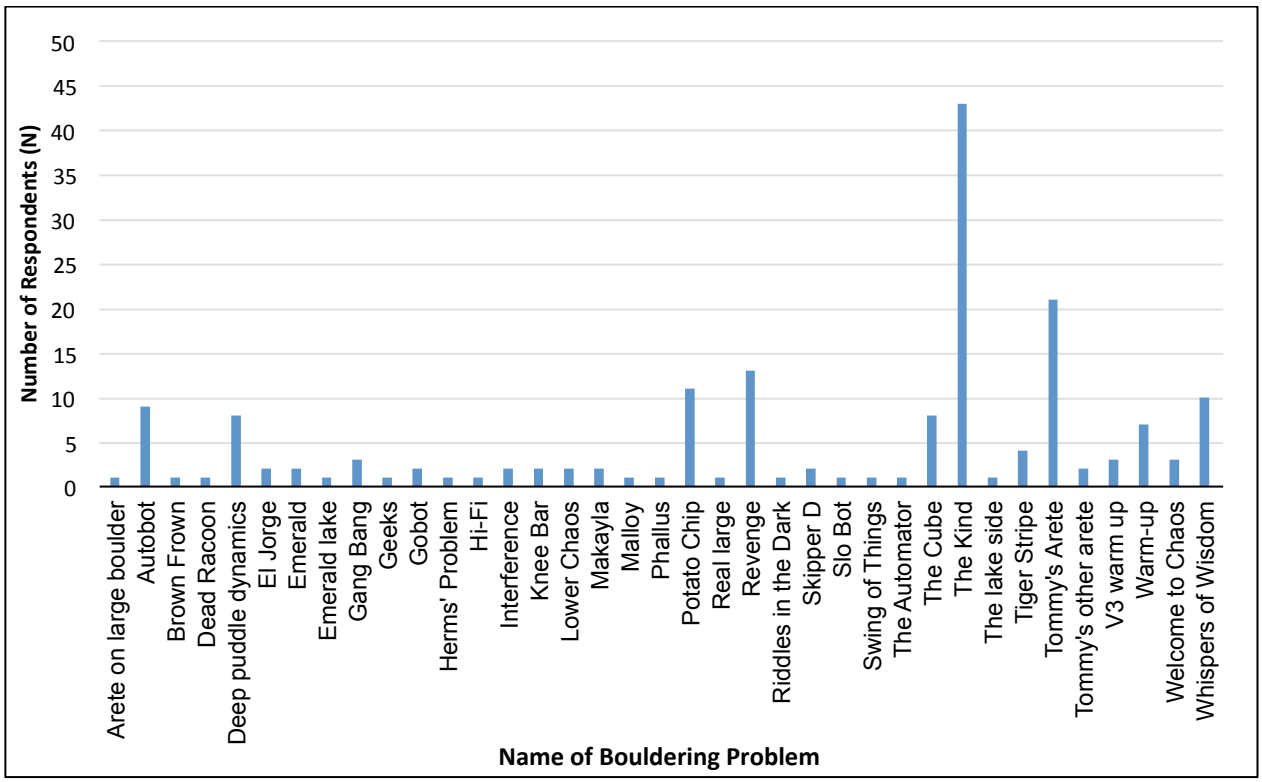

Figure 3. Boulder problem respondents' reported to have spent the most time on during day of interview.

Global Perceptions of Leave No Trace

Respondents reported overall high support for the Leave No Trace program (Table 13). Mean values for the statements suggesting support for Leave No Trace were above 5.70, indicating that boulderers perceive Leave No Trace positively on a global level. For example, over 90% of respondents answered with a "6" or "7" to the items *Practicing Leave No Trace protects the environment* (M = 6.52) and *It is important that all visitors practice Leave No Trace* (M = 6.57). This implies further that the majority of respondents perceive Leave No Trace to be an important approach to minimizing recreation-related impacts in RMNP. Moreover, the majority of respondents disagreed that *Practicing Leave No Trace limits my freedom in the outdoors* and that *Practicing Leave No Trace is time consuming*, indicating that Leave No Trace behaviors do not constrain the quality of outdoor recreation experiences.

Table 13. Global perceptions of Leave No Trace.

Items	*N*	*Mean*	*SD*	Percentage						
				Strongly Disagree						***Strongly Agree***
				1	**2**	**3**	**4**	**5**	**6**	**7**
Practicing “Leave No Trace” limits my freedom in the outdoors	226	2.04	1.232	39	40	9	6	4	1	1
Practicing “Leave No Trace” is time consuming	226	2.85	1.671	25	31	9	12	17	4	2
I practice “Leave No Trace” because the people I recreate with believe it is important	222	5.70	1.435	2	3	2	14	12	32	36
I insist that “Leave No Trace” practices are followed by all members of my group	226	6.12	1.209	0	3	1	7	18	32	39
It is important that park regulations require all visitors to practice “Leave No Trace”	225	6.30	1.007	0	0	0	5	12	26	56
Practicing “Leave No Trace” protects the environment	223	6.52	.905	1	0	0	3	4	25	67
It is important that all visitors practice “Leave No Trace”	222	6.57	.732	0	0	1	1	8	22	69

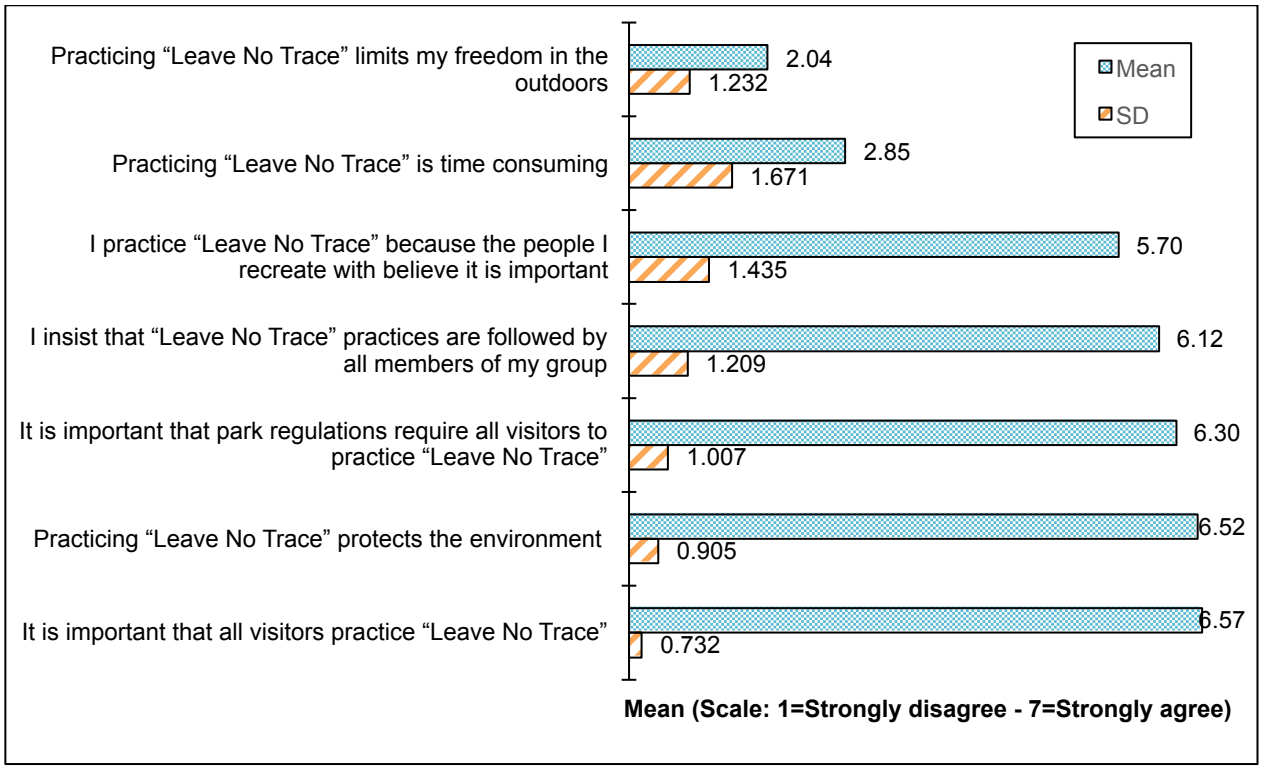

Figure 4. Global perceptions of Leave No Trace.

Attitudes toward Leave No Trace recommended practices

Attitudes toward the *appropriateness* of the behaviors of interest were evaluated with nine bouldering-specific statements and four general Leave No Trace behavior statements (Table 14). Attitudes toward *appropriateness* were found to be mostly congruent with the general Leave No

Trace behavior statements, though they varied depending on the principle in question. For example, 90% of respondents (M = 1.45) answered with a "1" or "2" to the item *Dropping food on the ground to provide wildlife as a food source* indicating the behavior to be considered *highly inappropriate*. The standard deviation for this item was also comparatively low, suggesting a higher level of agreement among respondents. Alternatively, the item *Scheduling a visit during times of high use* was evaluated as being slightly more *appropriate*, as 80% of respondents (M = 4.18) scored the statement with a "4" or higher. This result is counter to what would be suggested of Leave No Trace-related recreation behaviors.

Regarding *appropriateness* of Leave No Trace-related behaviors specific to bouldering, attitudes generally aligned with recommended practices. However, results indicated less congruence with behaviors more specific to safety and accessing or maintaining bouldering opportunities in the park. The item *Removing/cleaning lichen, moss, or plants from a boulder to establish a new route* was assessed as *somewhat appropriate*, with 70% of respondents answering with a "4" or higher. Moreover, the item *Traveling off designated trails to access boulders* resulted in a mean of 3.85, thus perceived as *inappropriate*; however, this was a comparatively higher mean score than many of the other behavioral items that were specific to bouldering. Furthermore, the standard deviation of 1.78 suggested less agreement among respondents about the *appropriateness* of this behavior. *Stashing crash pads near bouldering problems for later use***,** *Leaving tick marks when done bouldering***,** and *Playing music through external speakers* were considered among the *least appropriate* bouldering specific activities (M = 2.92, 2.92, and 2.43 respectively).

Table 14. Attitudes toward Leave No Trace recommended practices.

				Percentage						
				Very Inappropriate						Very Appropriate
Behaviors	***N***	***Mean***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Dropping food on the ground to provide wildlife a food source	228	1.45	1.012	75	15	4	4	0	0	1
Playing music through external speakers	227	2.43	1.359	32	25	20	16	3	2	1
Stashing crash pads near bouldering problems for later use	229	2.92	1.623	26	19	19	22	7	6	3
Leaving tick marks when done bouldering	226	2.92	1.508	20	25	22	22	4	7	2
Moving rocks, trees, or shrubs at the base of a boulder for better/easier access	225	2.92	1.499	20	25	20	21	8	2	3
Keeping a single item like a rock, plant, stick, or feather as a souvenir	226	2.98	1.601	21	24	19	19	9	5	3
Traveling side by side in a group on existing trails	227	3.20	1.485	14	19	28	24	5	8	2
Placing gear and crash pads on vegetation (grasses, trees, shrubs, moss, etc.)	228	3.22	1.497	14	19	28	21	11	6	2
Traveling off designated trails to access boulders	226	3.76	1.783	14	12	19	21	13	13	7
Spreading out gear and crash pads to establish a “base-camp” while at the crag	229	3.84	1.512	6	14	18	33	11	13	4
Moving rocks, trees, or shrubs at the base of a boulder to develop a safer landing zone	227	3.85	1.694	9	15	18	22	15	15	6
Scheduling a visit during times of high use	225	4.18	1.526	8	7	5	51	6	17	7
Removing/cleaning lichen, moss, or plants from a boulder to establish a new route	228	4.72	1.614	5	5	12	22	16	28	12

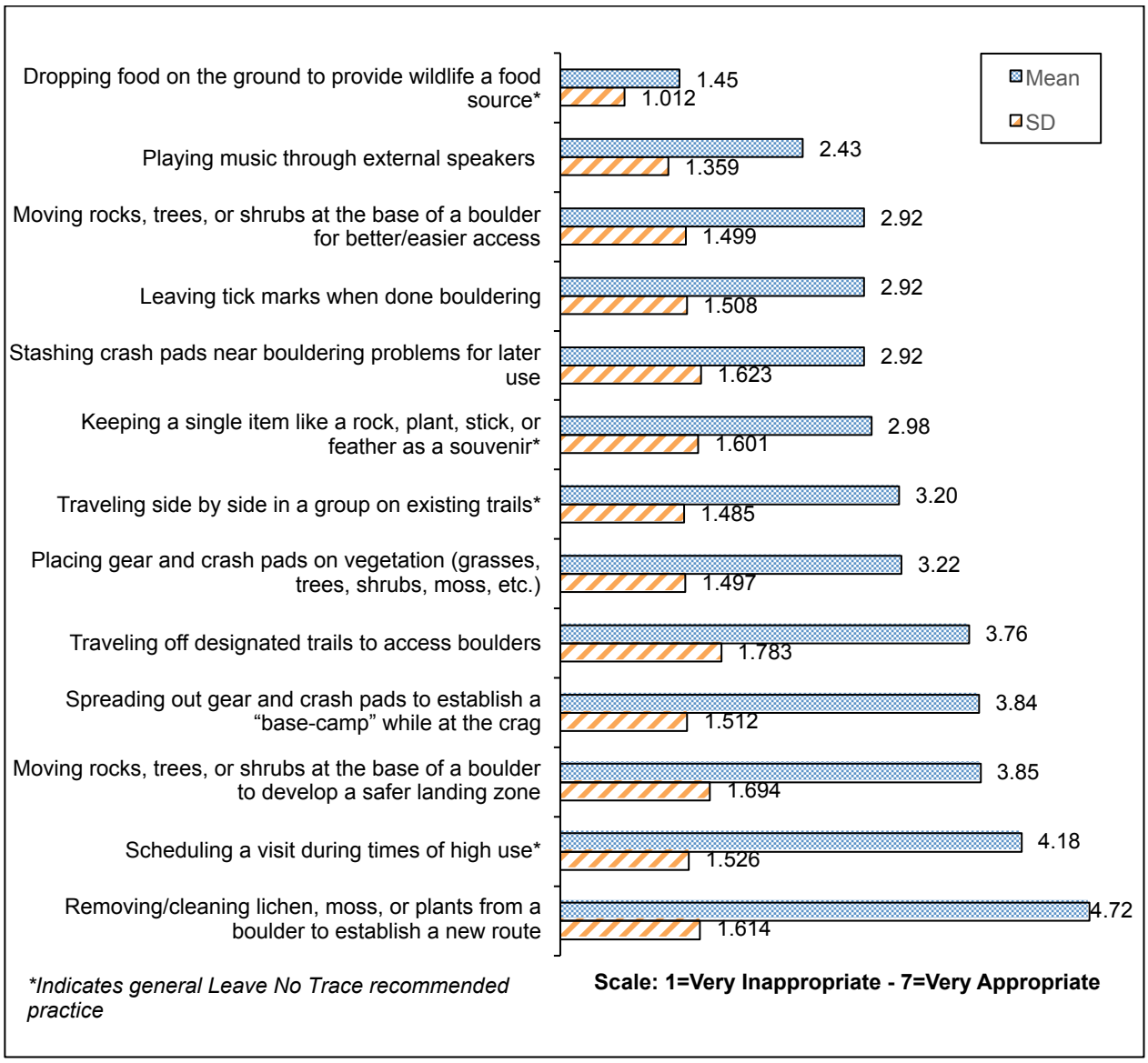

Figure 5. Attitudes toward Leave No Trace recommended practices.

Perceived Effectiveness of Leave No Trace recommended practices

To assess perceived *effectiveness* of Leave No Trace recommended practices, respondents were asked to indicate the extent to which certain behaviors would reduce impact while bouldering in RMNP (Table 15). Nine general Leave No Trace-related behavioral statements and seven items specific to minimum impact bouldering in RMNP were evaluated. All of the general Leave No Trace items were perceived as *slightly* to *highly effective* with scale means ranging from 4.64 to 6.89. Similar to the results of the *appropriateness* measures, *Scheduling a visit to avoid times of high use* was perceived to be the *least effective* of the behaviors in question (M = 4.64). The practice of *Carrying out all litter, even crumbs, peels, or cores* was perceived to be the *most effective* of the general Leave No Trace statements (M = 6.89). And the standard deviation of .857 suggested strong agreement among respondents regarding this behavior.

Leave No Trace-related behaviors specific to bouldering in RMNP were also all perceived as *slightly* to *highly effective*. In this case scale means ranged from 4.57 to 6.15. The statement *Leaving existing lichen, moss, or plants intact at boulder problems* was answered with a "4" or less by 53% of respondents, suggesting that this behavior was perceived as the *least effective* of the practices in question – a result similar to the findings in the *appropriateness* measures. Alternatively, *Carrying crash pads out of the park each time you exit* was perceived as the *most effective* of the bouldering specific behaviors (M = 6.15), and the comparatively lower standard deviation of 1.145 suggested fairly strong agreement among respondents.

Table 15. Effectiveness of Leave No Trace recommended practices in reducing negative impacts while bouldering in RMNP.

				Percentage						
				Never Effective						*Effective Every Time*
Behaviors	***N***	***Mean***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Leaving existing lichen, moss, or plants intact at boulder problems	224	4.57	1.666	4	7	17	25	17	13	18
Scheduling a visit to avoid times of high use	225	4.64	1.617	5	6	10	22	25	18	14
Taking breaks away from the trail and other visitors	220	4.90	1.588	2	8	8	21	20	24	17
Removing tick marks when done bouldering	225	5.44	1.650	3	4	7	10	19	20	36
Playing music at a level that only you, or your immediate group can hear it	224	5.45	1.843	7	5	5	9	10	25	39
Walking single file in the middle of the trail, even when wet or muddy	225	5.53	1.299	1	1	3	14	24	30	27
Keeping the footprint of gear and crash pads to a minimum while at the crag	223	5.63	1.291	0	1	5	17	17	27	33
Staying on designated or established trails	223	5.65	1.289	0	2	4	12	22	28	32
Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	223	5.75	1.414	1	1	5	21	19	19	34
Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	224	5.79	1.400	1	2	6	9	15	25	42
Preparing for all types of weather, hazards, or emergencies before I get on the trail	224	5.86	1.218	0	2	4	7	18	31	38
Placing gear and crash pads on durable surfaces	223	5.95	1.169	0	0	3	7	22	24	43
Carrying crash pads out of the park each time you exit	224	6.15	1.145	0	0	3	8	13	22	54
Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	225	6.43	1.116	1	1	1	5	8	14	71
Avoiding approaching, feeding, or following wildlife	225	6.52	1.477	4	2	0	2	8	21	63
Carrying out all litter, even crumbs, peels, or cores	222	6.89	.857	0	0	1	5	5	14	75

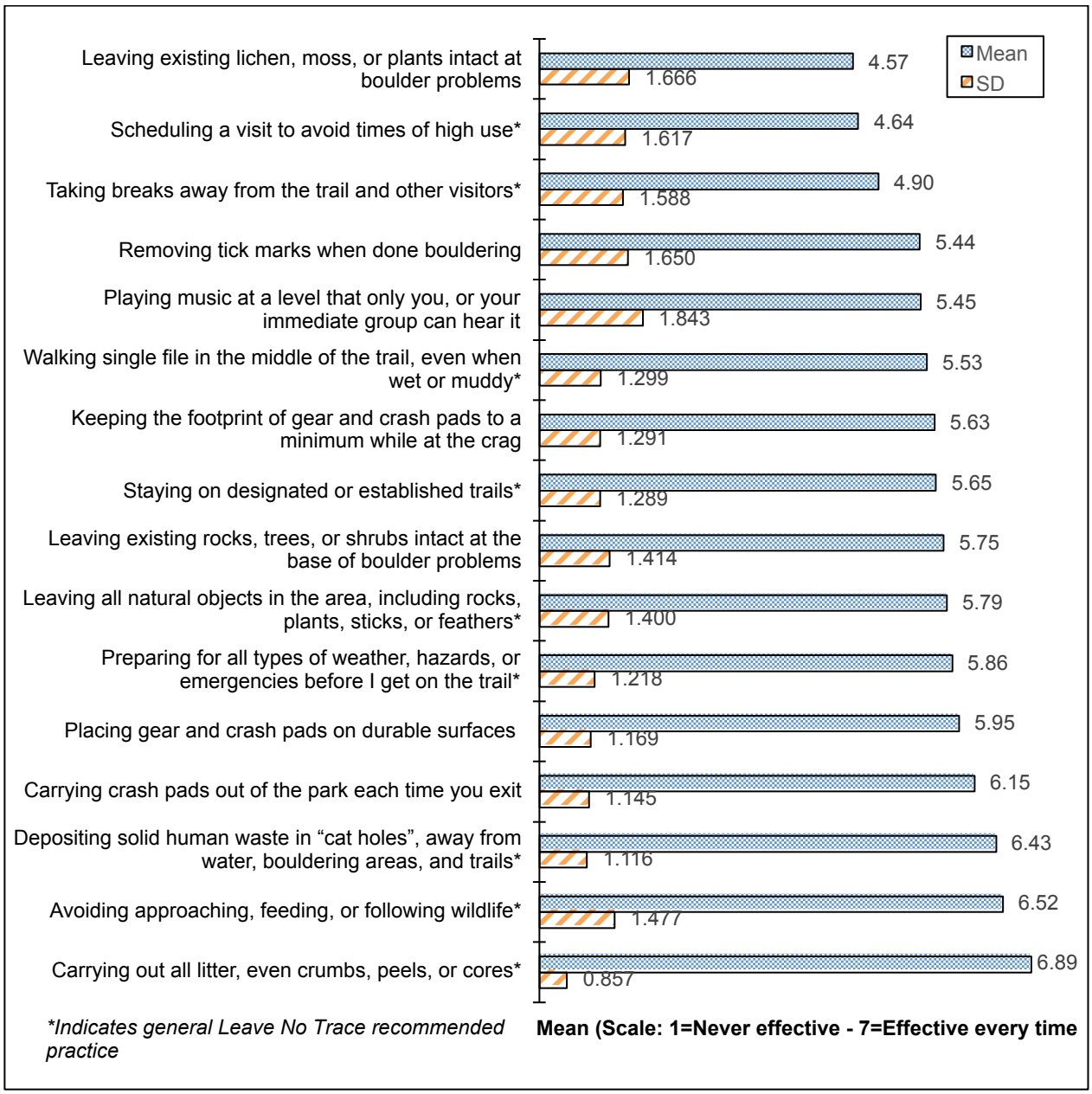

Figure 6. Effectiveness of Leave No Trace recommended practices in reducing negative impacts while bouldering in RMNP.

Perceived Difficulty of performing Leave No Trace recommended practices

Respondents were provided the same set of behavioral statements as in the *effectiveness* measures, but instead asked to rate the *difficulty* of performing each behavior while bouldering in RMNP (Table 16). In terms of the general Leave No Trace behavioral statements, all but one (*Scheduling a visit to avoid times of high use*, M = 3.95) resulted in a mean score above “5” on the scale, indicating the behaviors are perceived to be *moderately* to *very easy* to perform. Of the behaviors that scored above “5”, *Staying on designated or established trails* was perceived to be the most *difficult* (M = 5.24).

In regard to the bouldering specific Leave No Trace-related behaviors, all but one (*Leaving existing lichen, moss, or plants intact at boulder problems*, M = 4.65) resulted in a mean score of "5" or above. Of those behavioral items scoring above "5", *Placing gear and crash pads on durable surfaces* and *Leaving existing rocks, trees, or shrubs intact at the base of boulder problems* were perceived as more *difficult* to perform (M = 5.21 and 5.25 respectively). Alternatively, *Carrying crash pads out of the park each time you exit* was perceived as one of the easier behaviors to practice, with 77% of respondents answering with a "6" or "7".

Table 16. Perceived difficulty of performing Leave No Trace recommended practices while bouldering in RMNP.

				Percentage						
				Very Difficult						Very Easy
Behaviors	***N***	***Mean***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Scheduling a visit to avoid times of high use	222	3.95	1.804	8	16	21	18	14	12	12
Leaving existing lichen, moss, or plants intact at boulder problems	221	4.65	1.787	5	10	13	19	19	14	21
Placing gear and crash pads on durable surfaces	223	5.21	1.492	0	4	12	15	22	21	26
Staying on designated or established trails	224	5.24	1.622	3	6	8	12	20	27	26
Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	221	5.25	1.623	1	2	14	18	17	13	35
Keeping the footprint of gear and crash pads to a minimum while at the crag	224	5.43	1.459	0	3	9	11	23	21	31
Removing tick marks when done bouldering	222	5.56	1.584	1	3	10	10	17	18	41
Taking breaks away from the trail and other visitors	223	5.59	1.404	0	2	8	10	21	23	35
Walking single file in the middle of the trail, even when wet or muddy	223	5.74	1.351	1	2	5	12	14	31	36
Preparing for all types of weather, hazards, or emergencies before I get on the trail	224	5.86	1.375	1	3	7	3	10	38	38
Carrying crash pads out of the park each time you exit	222	6.02	1.464	1	2	6	6	8	21	56
Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	224	6.10	1.286	0	0	7	7	10	18	57
Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	221	6.30	1.037	0	0	3	5	8	25	58
Playing music at a level that only you, or your immediate group can hear it	224	6.40	1.241	2	1	2	5	4	16	71
Carrying out all litter, even crumbs, peels, or cores	224	6.50	.908	0	0	2	2	5	23	67
Avoiding approaching, feeding, or following wildlife	224	6.59	.804	0	0	1	2	4	21	72

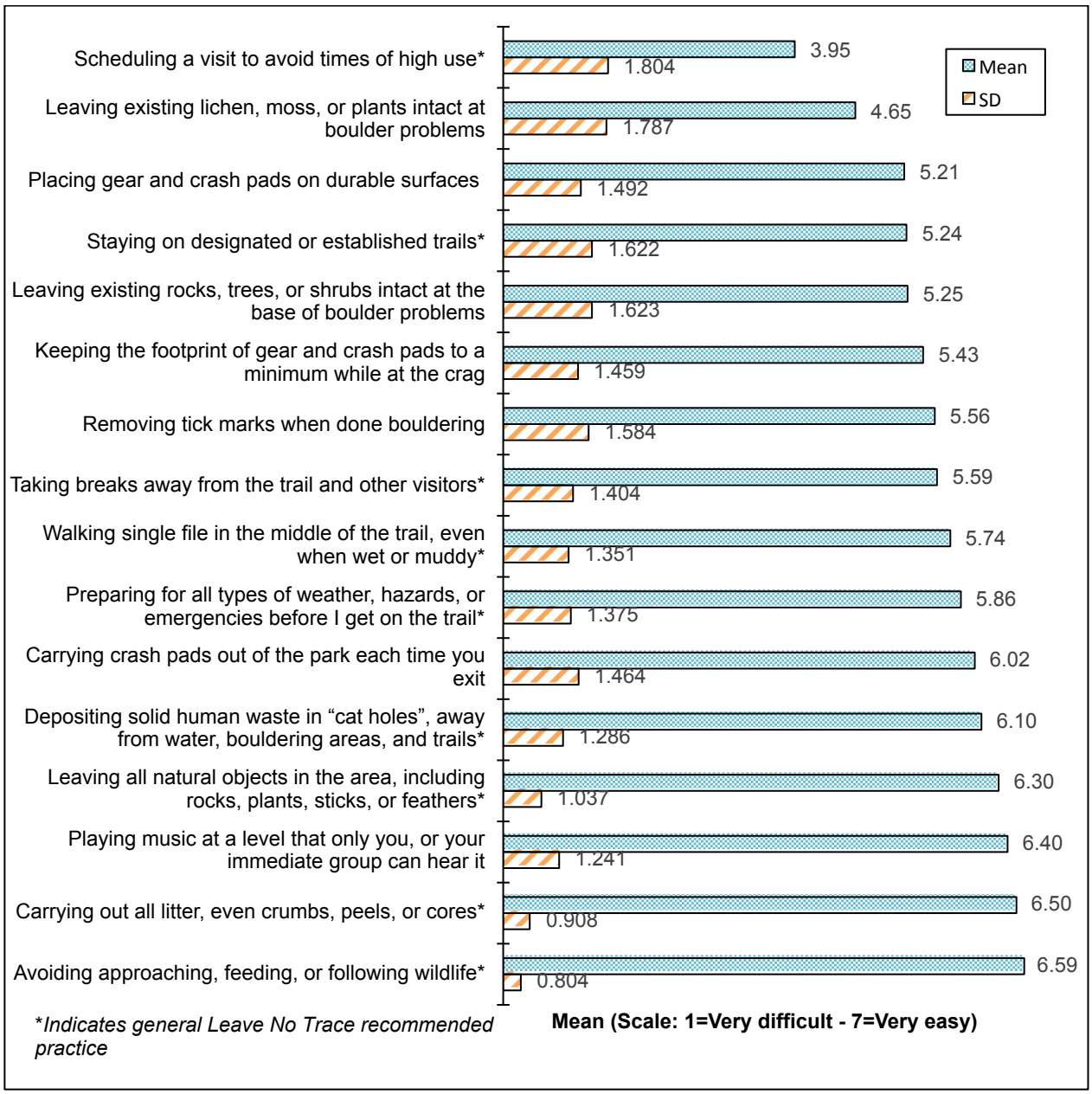

Figure 7. Perceived difficulty of performing Leave No Trace recommended practices while bouldering in RMNP.

Frequency of performing recommended minimum-impact behaviors

Response categories were Always, Sometimes, or Never. As illustrated in Table 17, *Carrying out all litter, even crumbs, peels, or cores*, *Carrying crash pads out of the park each time you exit*, and *Avoiding approaching, feeding, or following wildlife* were among the most commonly practiced behaviors. Conversely, *Scheduling a visit to avoid times of high use*, *Taking breaks away from the trail and other visitors*, and *Staying on designated or established trails* were among the behaviors practiced less frequently. It should be noted that the item *Playing music at a level that only you, or your immediate group can hear it* may have been misunderstood by respondents, and therefore the

results may be misleading. While 24% of respondents indicated they *Never* perform the behavior, many respondents explained to survey administrators that they responded this way because they never play music through portable speakers.

Table 17. Frequency of performing recommended minimum-impact behaviors.

	Percentage		
Behavior	**Always**	**Sometimes**	**Never**
Scheduling a visit to avoid times of high use	6	66	28
Taking breaks away from the trail and other visitors	29	62	9
Leaving existing lichen, moss, or plants intact at boulder problems	40	55	5
Staying on designated or established trails	42	57	1
Removing tick marks when done bouldering	42	46	12
Placing gear and crash pads on durable surfaces	44	56	1
Keeping the footprint of gear and crash pads to a minimum while at the crag	45	55	1
Walking single file in the middle of the trail, even when wet or muddy	46	51	2
Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	58	42	0
Playing music at a level that only you, or your immediate group can hear it	63	13	24
Preparing for all types of weather, hazards, or emergencies before I get on the trail	66	33	0
Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	74	25	1
Depositing solid human waste in “cat holes”, away from water, bouldering areas, and trails	86	10	4
Avoiding approaching, feeding, or following wildlife	90	6	4
Carrying crash pads out of the park each time you exit	90	9	1
Carrying out all litter, even crumbs, peels, or cores	91	9	0

Intent to perform recommended minimum-impact behaviors

Respondents were provided the same list of behaviors as in the ‘Frequency’ section discussed above, but this time asked to indicate how likely they are to perform each while bouldering in RMNP in the future (Table 18). Behavioral intentions, according to the Theory of Planned Behavior, are a strong predictor of actual behavior. Measures of behavioral intent are often used as surrogates in social science research when measures of actual behavior are unavailable. Following this hypothesized relationship, the findings here provide insight into the likelihood of boulderers performing certain behaviors while in RMNP. The results here follow a similar trend as those discussed in the ‘Frequency’ section above. Focusing on the bouldering specific behaviors of interest, we find that *Carrying crash pads out of the park each time you exit* has a very high likelihood of being performed, as approximately 90% of respondents answered with a “5” or higher. Alternatively, respondents indicated relatively less intent regarding *Leaving existing lichen, moss, or plants intact at boulder problems* (M = 5.37) and *Removing tick marks when done bouldering* (M = 5.51). *Staying on designated or established trails* also ranked on the lower end of the intention scale (M = 5.59). It is worth noting that while these behaviors are on the lower end relative to the other behaviors in question, they are still above the *Neutral* point on the scale. Moreover, the majority of respondents

expressed positive intent to perform all of the behaviors listed in the survey, as all items were scored above "4" on the scale. Those items on the lower end might indicate areas that merit increased focus in efforts to influence greater adoption of recommended minimum-impact practices.

Table 18. Intent to perform recommended minimum-impact behaviors in the future.

				Percentage						
				Very Unlikely						Very Likely
Behaviors	***N***	***Mean***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Scheduling a visit to avoid times of high use	220	4.32	1.714	10	8	9	21	26	17	9
Taking breaks away from the trail and other visitors	216	5.36	1.446	2	3	2	18	26	20	28
Leaving existing lichen, moss, or plants intact at boulder problems	222	5.37	1.445	2	2	5	20	19	25	28
Removing tick marks when done bouldering	222	5.51	1.608	4	3	6	10	18	23	36
Staying on designated or established trails	215	5.59	1.272	1	1	5	13	20	33	27
Keeping the footprint of gear and crash pads to a minimum while at the crag	219	5.66	1.136	1	0	2	13	23	36	25
Playing music at a level that only you, or your immediate group can hear it	216	5.66	2.189	14	3	1	4	4	12	63
Walking single file in the middle of the trail, even when wet or muddy	221	5.76	1.218	1	1	2	9	22	33	32
Placing gear and crash pads on durable surfaces	221	5.76	1.094	0	1	2	12	21	36	29
Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	221	5.97	1.165	1	0	1	10	18	27	43
Preparing for all types of weather, hazards, or emergencies before I get on the trail	221	6.32	1.005	0	1	2	2	8	31	56
Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	220	6.35	1.026	0	1	1	7	11	17	64
Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	221	6.49	1.119	2	1	1	3	6	15	74
Carrying crash pads out of the park each time you exit	218	6.50	1.141	1	1	1	6	3	10	78
Avoiding approaching, feeding, or following wildlife	218	6.57	1.198	3	0	0	2	4	9	82
Carrying out all litter, even crumbs, peels, or cores	221	6.70	.782	1	0	1	2	4	12	81

Perceptions of impacts

A number of perceived social and ecological impacts related to bouldering in RMNP were identified during the key informant interviews. Respondents were presented with a list of these impacts and asked to evaluate the extent to which they perceived these to be problems using a four-point scale anchored from 1 = Not a problem to 4 = Major problem (Table 19). *Vegetation loss at the base of boulders* (M = 2.52) and *Stashing crash pads for later use* (M = 2.46) were among the issues perceived as most problematic in RMNP. An unanticipated issue that surfaced during the interviews was the notion that boulderers are frequently stopped by other park visitors and asked what "the thing on their back" (crash pad) is used for. Respondents explained this becomes an issue because the

approach to the bouldering areas involves an extended hike at altitude (~45 minutes) and being stopped at random to engage in conversation with other visitors cuts in to their often limited recreational opportunity time. Not surprisingly, this was reported to be the most problematic issue when bouldering at RMNP (M = 2.60). Interestingly, the standard deviation for this time was 1.26 – the largest SD of all items in this block of questions – which suggests disagreement among respondents as to the extent of the issue. It is possible that some respondents were not stopped and therefore did not perceive it as a problem, or perhaps were less focused on getting to the bouldering site and didn't mind stopping for brief conversation.

Table 19. Perceptions of bouldering-related social and ecological impacts in RMNP.

				Evaluation of Condition				
Condition	***N***	***Mean***	***SD***	**Not a Problem**	**Minor**	**Moderate**	**Major**	**Don't Know/ No Opinion***
Vegetation loss at the base of boulders	225	2.52	.812	9	32	36	8	15
Excessive chalk and tick marks on boulders	225	2.38	.845	14	38	33	8	7
Moving rocks, trees, or shrubs at the base of boulders to develop safer landing zones	224	2.21	.822	17	38	27	5	13
Hearing music being played through external speakers	225	2.22	1.06	28	27	20	14	12
Stashing crash pads for later use	226	2.46	.973	15	31	24	15	16
The presence of human waste near trails or bouldering sites	223	2.40	1.21	26	18	13	22	21
The presence of trash at bouldering sites	226	2.43	1.12	23	26	18	21	12
Excessive social trails leading to bouldering sites	226	2.28	1.12	23	32	25	12	9
Crowding at bouldering sites	226	2.46	.841	13	30	39	8	11
Park visitors stopping me to ask what my crash pad is used for	225	2.60	1.26	30	13	18	35	4

**Don't Know/No opinion responses not included in Mean and Std Dev calculations*

Place attachment and resource specificity

Respondents were asked to indicate the extent to which they agreed with six statements designed to evaluate their level of attachment associated with RMNP and the importance they place on RMNP as a specific bouldering destination (Table 20). Approximately 87% of respondents responded with a "6" or higher (M = 6.46) to the statement *Rocky Mountain National Park means a lot to me*, and the standard deviation of .891 indicates relatively strong agreement among the sample. There was slightly less agreement with the statement *I am very attached to Rocky Mountain National Park*, with nearly a quarter of the sample choosing the *Neutral* response option, though the mean score of 5.45 still suggests relatively high levels of attachment. In terms of resource specificity, responses to the

statements *Bouldering in Rocky Mountain National Park is more important to me than bouldering in any other place* resulted in a mean of 3.86 and *I enjoy bouldering in Rocky Mountain National Park more than any other place* yielded a mean of 4.77. Taken together these results might suggest that respondents feel a strong sense of attachment to RMNP in general, though it appears to be of less importance as a specific bouldering location.

Table 20. Place attachment and resource specificity.

				Percentage						
				Strongly Disagree						***Strongly Agree***
Statement	***N***	***Mean***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rocky Mountain National Park means a lot to me	225	6.46	.891	0	0	0	6	6	22	65
I enjoy bouldering in Rocky Mountain National Park more than any other place	223	4.77	1.597	3	9	7	25	23	16	18
I feel no commitment to Rocky Mountain National Park	225	2.02	1.255	45	31	8	11	4	1	0
I am very attached to Rocky Mountain National Park	226	5.45	1.395	1	3	3	22	16	27	29
Bouldering in Rocky Mountain National Park is more important to me than bouldering in any other place	224	3.86	1.571	5	21	8	37	15	8	7
If informed that my actions in the Park damaged the environment, I would change my behavior	225	6.32	.900	0	0	0	4	11	32	53

Crowding and displacement

To examine the extent to which respondents felt a sense of crowding at the bouldering sites we asked them to indicate how the number of people they saw bouldering during their visit compared with their expectations, how crowded they felt while bouldering and whether the number of other boulderers affected their experience, as well as whether or not they moved to a different location based on the number of people they encountered.

Approximately 78% of respondents saw less than, or about what they expected to see (Table 21).

Table 21. Expectations for the number of other people that would be bouldering.

How did the number of people you saw bouldering during your visit compare with what you expected?	***N***	***Percent***
A lot less than what you expected	17	8
A little less than what you expected	48	21
About what you expected	110	49
A little more than what you expected	32	14
A lot more than what you expected	13	6
You did not have any expectations	6	3

Forty-six percent reported feeling *Not at all crowded*, while about one quarter of the sample felt *Slightly crowded* (Table 22).

Table 22. Perceptions of crowding while bouldering in RMNP.

How crowded did you feel while bouldering at Rocky Mountain National Park today?	***N***	***Percent***
Not at all crowded	104	46
Slightly crowded	57	25
Moderately crowded	52	23
Very crowded	9	4
Extremely crowded	2	1

The vast majority of respondents felt that the number of other boulderers they encountered either added to, or had no effect, on their overall experience (Table 23)

Table 23. Effect of other boulderers on overall experience while bouldering in RMNP.

How did the number of other boulderers you encountered affect your overall experience today?	***N***	***Percent***
Added greatly	34	15
Added somewhat	57	25
Had no effect	110	49
Detracted somewhat	22	10
Detracted greatly	1	0

Approximately 17% of respondents reported to have moved locations based on the number of people they encountered (Table 24).

Table 24. Displacement due to crowding at bouldering locations.

Did you move to a different boulder based on the number of people you encountered?	***N***	***Percent***
No	185	83
Yes	37	17

Familiarity with outdoor bouldering ethics and knowledge of Leave No Trace

The majority of respondents (94%) indicated that they were familiar with outdoor bouldering ethics (Table 25).

Table 25. Self-reported familiarity with outdoor bouldering ethics.

Are you familiar with outdoor bouldering ethics?	***N***	***Percent***
No	13	6
Yes	207	94

When asked to describe their current level of knowledge of Leave No Trace practices, 78% felt they were a "4" or above (M = 4.17) on the scale provided (Table 26). The scale used to measure knowledge of Leave No Trace was anchored from 0 = No Knowledge to 6 = Expert (Table 26).

Table 26. Self-reported knowledge of Leave No Trace practices.

			Percentage						
			No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
N	***Mean***	***SD***	**0**	**1**	**2**	**3**	**4**	**5**	**6**
202	4.17	.931	0	0	3	20	45	24	9

Results related to differences in respondent groups (a function of where they learned to climb and self-reported bouldering ability)

To answer research questions three and four, we grouped respondents in to one of four categories based on the location where they learned to boulder and their self-reported bouldering ability. Categories included: *Indoor novice*, *Indoor advanced*, *Outdoor novice*, and *Outdoor advanced*. Categories were mutually exclusive, meaning that each respondent could be assigned to only one category. See Table 27 for a complete presentation of statistically significant findings related to this analysis. Of particular interest to this study are the findings related to self-reported knowledge of Leave No Trace. As illustrated in Figure 8, those who learned to boulder indoors fell on the lower end of the knowledge scale, with *Indoor novices* reporting the least amount of knowledge (M = 3.83), followed by those in the *Indoor advanced* category (M = 4.11). On the upper end are those who learned to boulder outdoors. Outdoor novices fell just below those in the *Outdoor advanced* category with mean scores of 4.20 and 4.59 respectively. These findings support the notion that those who learn to boulder indoors are entering the sport, and eventually the outdoors, with significantly less knowledge of Leave No Trace recommended practices.

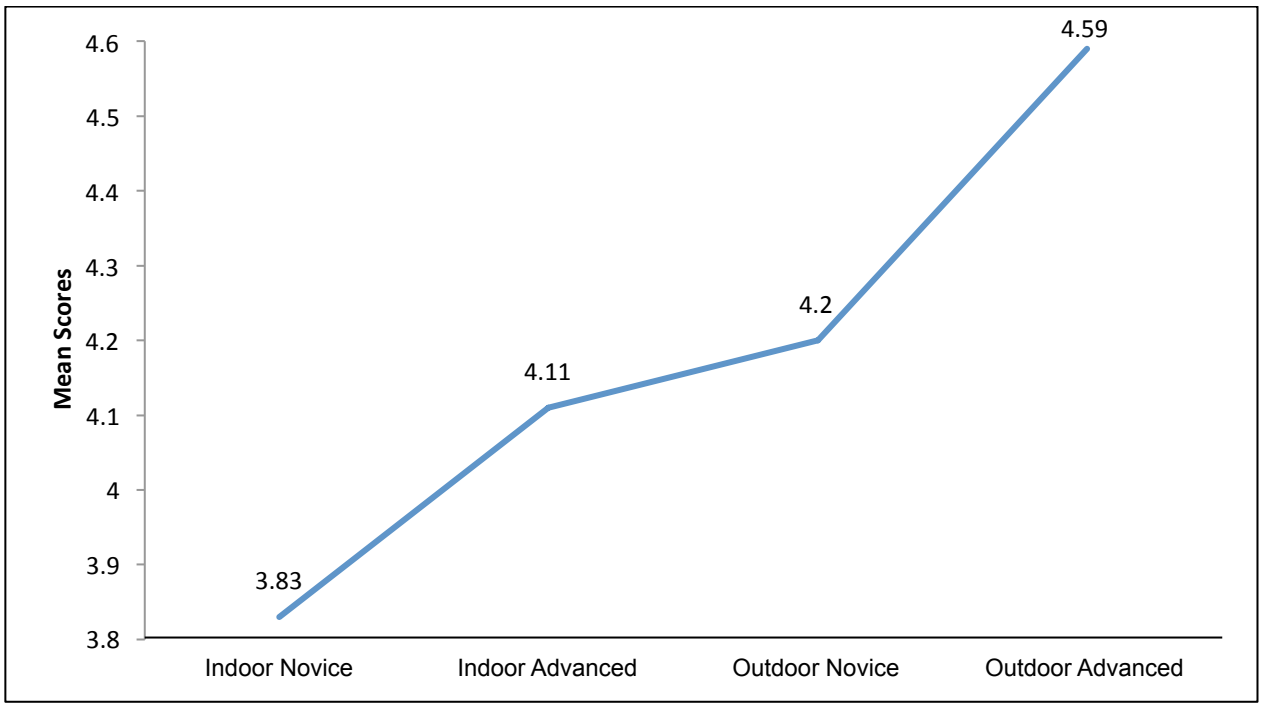

Figure 8. Self-reported knowledge of Leave No Trace by respondent category.

Several significant differences between respondent groups across attitudinal measures were also identified. These results are also illustrated in Table 27. For example, the practice of *Leaving/removing tick marks when done bouldering* appeared in the *Difficulty, Appropriateness,* and *Behavioral Intent* comparisons. Respondents in the *Indoor* and *Outdoor Novice* categories perceived removing tick marks to be more difficult than did those in the *Indoor* and *Outdoor Advanced* categories. They also felt leaving tick marks when done bouldering was a more appropriate practice relative to those in the *Advanced* categories. Finally, those in the *Outdoor Advanced* category were significantly more likely to report that they intend to remove tick marks when done bouldering in the future. Taken together, these results seem to indicate general disagreement or misunderstanding about minimum-impact recommendations related to tick marks on bouldering routes.

Table 27. Analysis of survey responses by respondent group (a function of place of learning and bouldering ability) – statistically significant results.

	Mean Scores[1]					
	Indoor Novice	**Outdoor Novice**	**Indoor Advanced**	**Outdoor Advanced**	***F***	***p-value***
Difficulty of performing Leave No Trace recommended practices (Scale: 1=Very Difficult – 7=Very Easy)						
Removing tick marks when done bouldering	5.29[a,b]	5.08[a]	5.55[a,b]	6.09[b]	3.033	.030
Appropriateness of performing Leave No Trace recommended practices (Scale: 1=Very Inappropriate – 7=Very Appropriate)						
Leaving tick marks when done bouldering	3.49[b]	3.19[a,b]	2.69[a,b]	2.52[a]	4.790	.003
Removing/cleaning lichen, moss, or plants from a boulder to establish a new route	4.10[a]	4.39[a,b]	5.12[b]	4.82[a,b]	5.099	.002
Spreading out gear and crash pads to establish a "base-camp" while at the crag	3.89[a,b]	4.39[b]	3.88[a,b]	3.32[a]	3.147	.026
Behavioral Intent (Scale: 1=Very Unlikely – 7=Very Likely)						
Removing tick marks when done bouldering	5.32[a]	4.92[a]	5.31[a]	6.27[b]	5.293	.002
Self-reported knowledge of Leave No Trace (Scale: 0=No Knowledge – 6=Expert)	3.83[a]	4.20[a,b]	4.11[a,b]	4.59[b]	5.021	.002
Perceptions of bouldering-related problems in RMNP (Scale: 1=Not a problem – 4=Major problem)						
Vegetation loss around the base of boulders	2.81[b]	2.52[a,b]	2.34[a]	2.71[a,b]	3.999	.009
Place attachment/identity and resource specificity (Scale: 1=Strongly disagree – 7=Strongly agree)						
Rocky Mountain National Park means a lot to me	6.35[a,b]	6.07[a]	6.43[a,b]	6.73[b]	3.195	.024
I enjoy bouldering in Rocky Mountain National Park more than any other place	4.62[b]	3.74[a]	4.97[b]	5.05[b]	5.039	.002
I feel no commitment to Rocky Mountain National Park	2.41[b]	2.04[a,b]	2.05[a,b]	1.63[a]	3.064	.029
I am very attached to Rocky Mountain National Park	5.27[a,b]	4.56[a]	5.45[b]	5.98[b]	6.355	.000
Bouldering in Rocky Mountain National Park is more important to me than bouldering in any other place	3.69[a,b]	3.07[a]	4.00[b]	4.07[b]	2.987	.032

[1]*Superscripts indicate significantly different groups – Tukey's post hoc*

Discussion

The purpose of this study was to examine the perceptions of boulderers in RMNP, to establish a baseline understanding of their attitudes toward Leave No Trace recommended practices. These data provide insight into specific behaviors where attitudes align with Leave No Trace recommendations, and those practices specific to bouldering where attitudinal gaps exist. Results indicate that, on a

global level, boulderers were highly supportive of Leave No Trace strategies and corresponding behaviors. Overall, they reported positive perceptions of Leave No Trace and felt it is an important means of minimizing recreation-related impacts. However, attitudes toward some bouldering specific behaviors were less favorable and merit additional attention. For example, *Moving rocks or trees at the base of a boulder to develop a safer landing zone* and the act of *Removing lichen, moss, or plants from a boulder to establish a new route* (a practice commonly referred to as "gardening") received greater support relative to the other Leave No Trace practices being evaluated. These identified attitudinal gaps between bouldering practices and Leave No Trace recommendations, which advocate no or minimal site alterations, highlight opportunities to develop collaborative solutions for mitigating potentially impactful behaviors related to bouldering in the park.

Of particular interest to this study were the findings suggesting differences in attitudes and knowledge when grouping respondents based on the place where they learned to boulder, and their self-reported bouldering ability. Significant differences in attitude and knowledge measures were identified across respondent categories based on where one learned to climb and their self-reported bouldering ability. Generally speaking, those who learned to climb indoors in a gym and reported lower levels of bouldering ability, were less knowledgeable of Leave No Trace and reported attitudes less in line with minimum-impact bouldering recommendations. These findings suggest that opportunities exist to deliver Leave No Trace and related minimum-impact bouldering information in the climbing gym setting, as well as other introductory-level instructional classes and workshops.

It is recognized that bouldering, like all outdoor recreation activities, comes with an inherent set of impacts that in many cases are aesthetically obvious. Clearly boulderers should be conscious of these impacts and take measures to adopt practices that mitigate these impacts (e.g. remove chalk tick marks, refrain from "gardening" on boulder problems, avoid creating new trails). However, it is important to recognize that many of these types of impacts are not entirely unique to bouldering. In other words, bouldering is not unlike many recreation activities that take place in wilderness, in that there is an inherent tension between recreational pursuits and wilderness character. For example, anglers often create informal trails in order to access desirable fishing locations; equestrian use can cause trail impacts that lead to erosion which is well documented in the recreation ecology literature; overnight campers clear vegetation for tents and camp sites (or agency has previously established a site by clearing vegetation for this purpose). However, managers often accept these recreation activities as "traditional" uses of wilderness and recognize the need to educate these users about Leave No Trace practices, monitor to understand changing resource conditions, and provide agency presence to enforce regulations to protect park resources.

With proactive interest to engage boulderers in the management process there is potential to develop specific minimum-impact practices associated with the activity. Research such as this provides insight to effective communication approaches to engage and educate this group in order to develop best messaging practices. Regarding implications for management, we offer the following suggestions in light of this research.

1. There is need to develop a "standard" set of minimum impact bouldering principles. The Leave No Trace Center for Outdoor Ethics along with other stakeholder groups are currently

in the process of developing these messages and materials and these findings will aid in the advancement of these strategies (B. Lawhon, personal communication, May 26, 2016). Once developed these principles should be disseminated widely across multiple outlets and mediums (e.g. websites, brochures, equipment, etc.).

2. Continue with, and expand upon, education and messaging efforts that are currently being initiated in RMNP via signage, website, and direct ranger and park volunteer contact. For example, park rangers might take a more active role to engage boulderers in brief conversations at the Bear Lake trailhead about the efforts being undertaken by the park, and how boulderers can make positive contributions to these efforts. The park website could be updated with more prominent focus on bouldering activities and recommendations for minimum-impact bouldering practices in the park. Interpretive signage could be installed at key trailheads (e.g. Bear Lake) that includes information for boulderers, as well as information for other visitors about the practice of bouldering in the park. This could serve two primary functions: First, messages could provide site-specific information for boulderers such as appropriate social and environmental practices; and second, awareness messages could be directed toward other visitors explaining the sport of bouldering, which could help mitigate concerns of boulderers being frequently questioned about the purpose of their equipment and visit.

3. Based on the high agreement of respondents about their willingness to change behaviors if they knew they were causing impacts, and the strong meaning and commitment they associate with the park, messaging that contains a notion of shared responsibility for resource protection might prove effective.

4. Continue with, and expand upon, collaborative efforts with external agencies and constituent groups in outreach and education efforts. Of note, nearly 70% of respondents in this study indicated they first learned to climb indoors in a gym. Furthermore, significant knowledge and attitudinal differences were found based on where one learned to climb. This research confirms the priority for park staff to focus education and outreach efforts not only within the park, but also externally through the climbing gym industry.

5. Finally, an important implication for wilderness stewardship is that the bouldering population tends to be composed primarily of a younger generation of users. It is important to not alienate this group of wilderness users but instead work with this community to help foster interest in wilderness protection amongst a new generation of wilderness stewards.

Conclusion

Wilderness managers must understand the perceptions of growing user-groups, such as boulderers, in order to develop management strategies that promote the protection of resources while maintaining quality recreational opportunities. The findings from this study may help inform the development and implementation of such strategies. This study found that boulderers' attitudes toward common Leave No Trace practices generally aligned with recommended behaviors. However, a number of

bouldering specific practices were identified to be less congruent with Leave No Trace-recommendations, indicating that opportunities exist to improve messaging efforts. Global perceptions of Leave No Trace were positive, suggesting that expansion of messaging and outreach specific to bouldering, in conjunction with the continued educational strategies currently promoted by the Leave No Trace Center and RMNP, could influence attitudes in a manner that better aligns with wilderness management objectives. Specifically, messaging could be crafted that focuses on the effectiveness and lack of difficulty associated with the practices currently perceived by some as limiting to bouldering opportunities. We have also identified significant differences in attitudes toward, and knowledge of, Leave No Trace practices depending on whether one initially learned to boulder indoors in a gym or in an outdoor setting. These findings confirm and provide support for continued and expanded efforts to work in collaboration with the gym climbing industry in the development and delivery of minimum-impact bouldering information and educational resources. Finally, these results provide baseline data regarding attitudes toward Leave No Trace behaviors, which perhaps after the implementation of additional education strategies specific to bouldering behaviors, can be monitored over time in conjunction with ecological conditions, to assess trends related to this growing wilderness activity.

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Appendix A. Survey Instrument

OMB Control #: 1024-0224
Current Expiration Date: 08-31-2015

ROCKY MOUNTAIN NATIONAL PARK VISITOR STUDY

1. **How many years have you been bouldering?** *(write in number)* _____
2. **How many years have you been bouldering at Rocky Mountain National Park?** *(write in number)* _____
3. **In what year did you first visit Rocky Mountain National Park?** *(write in the year)* _____
4. **Approximately how many days a year do you boulder outside?** *(check one)*
   ☐<10 days/year ☐11-20 days/year ☐21-30 days/year ☐31-40 days/year ☐41-50 days/year ☐>50 days/year
5. **Approximately how many days a year do you boulder at Rocky Mountain National Park?** *(check one)*
   ☐<10 days/year ☐11-20 days/year ☐21-30 days/year ☐31-40 days/year ☐41-50 days/year ☐>50 days/year
6. **Approximately how many days a year do you boulder indoors in a gym?** *(check one)*
   ☐<10 days/year ☐11-20 days/year ☐21-30 days/year ☐31-40 days/year ☐41-50 days/year ☐>50 days/year
7. **What category best describes your overall ability as a boulderer?** *(check one)*
   ☐Beginner (V0-V2) ☐Intermediate (V3-V5) ☐Advanced (V6-V9) ☐Expert (V10-V15)
8. **What type of climber are you predominately?** *(check one)*
   ☐Roped (Sport, Traditional, etc.) ☐Un-roped (Boulderer)
9. **Where did you learn to climb?** *(check one)*
   ☐Indoors at a rock gym ☐Outdoors
10. **Who taught you to climb?** *(check one)*
    ☐Family members (informally) ☐Friends (informally)
    ☐Climbing club (informally) ☐Took a course from University/College (formal instruction)
    ☐Took a course from outfitter/guide (formal instruction) ☐Other: _____
11. **In general, where do you most prefer to boulder (regardless of season, weather, availability of climbing partners)?** *(check one)*
    ☐Gyms ☐Front country (road-side crags, easy/short approaches) ☐Back country (i.e. remote areas, long approaches)
12. **Which bouldering area in Rocky Mountain National Park do you typically spend most of your time:** *(check one)*
    ☐Chaos Canyon ☐Wild Basin ☐Endo Valley ☐Emerald Lake ☐Elkland ☐Other _____
13. **What specific bouldering problem did you spend the most time on <u>TODAY?</u>** *(write in response)* _____

14. When bouldering in Rocky Mountain National Park, please indicate the level of APPROPRIATENESS of the following activities. *(Circle the number of your response for each statement)*	Very Inappropriate	Slightly Inappropriate	Neutral	Slightly Appropriate	Very Appropriate		
a. Playing music through external speakers	1	2	3	4	5	6	7
b. Stashing crash pads near bouldering problems for later use	1	2	3	4	5	6	7
c. Moving rocks, trees, or shrubs at the base of a boulder to develop a safer landing zone	1	2	3	4	5	6	7
d. Leaving tick marks when done bouldering	1	2	3	4	5	6	7
e. Traveling off designated trails to access boulders	1	2	3	4	5	6	7
f. Dropping food on the ground to provide wildlife a food source	1	2	3	4	5	6	7
g. Scheduling a visit during times of high use	1	2	3	4	5	6	7
h. Moving rocks, trees, or shrubs at the base of a boulder for better/easier access	1	2	3	4	5	6	7
i. Placing gear and crash pads on vegetation (grasses, trees, shrubs, moss, etc.)	1	2	3	4	5	6	7
j. Keeping a single item like a rock, plant, stick, or feather as a souvenir	1	2	3	4	5	6	7
k. Traveling side by side in a group on existing trails	1	2	3	4	5	6	7
l. Removing/cleaning lichen, moss, or plants from a boulder to establish a new route	1	2	3	4	5	6	7
m. Spreading out gear and crash pads to establish a "base-camp" while at the crag	1	2	3	4	5	6	7

15. Please indicate how EFFECTIVE the following activities would be at reducing negative impacts while bouldering in Rocky Mountain National Park. *(Circle the number of your response for each statement)*	Never Effective	Rarely Effective	Occasionally Effective	Sometimes Effective	Frequently Effective	Usually Effective	Effective Every Time
a. Preparing for all types of weather, hazards, or emergencies before I get on the trail	1	2	3	4	5	6	7
b. Scheduling a visit to avoid times of high use	1	2	3	4	5	6	7
c. Staying on designated or established trails	1	2	3	4	5	6	7
d. Walking single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	1	2	3	4	5	6	7
g. Avoiding approaching, feeding, or following wildlife	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	1	2	3	4	5	6	7
i. Keeping the footprint of gear and crash pads to a minimum while at the crag	1	2	3	4	5	6	7
j. Playing music at a level that only you, or your immediate group can hear it	1	2	3	4	5	6	7
k. Carrying crash pads out of the park each time you exit	1	2	3	4	5	6	7
l. Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	1	2	3	4	5	6	7
m. Removing tick marks when done bouldering	1	2	3	4	5	6	7
n. Leaving existing lichen, moss, or plants intact at boulder problems	1	2	3	4	5	6	7
o. Placing gear and crash pads on durable surfaces	1	2	3	4	5	6	7
p. Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	1	2	3	4	5	6	7

16. The same activities are listed below. Regardless of how effective you think each of the following activities are, please indicate how DIFFICULT you think each of the following activities would be for you to do while bouldering in Rocky Mountain National Park. *(Circle the number of your response for each statement)*	Very Difficult	Difficult	Slightly Difficult	Neutral	Slightly Easy	Easy	Very Easy
a. Preparing for all types of weather, hazards, or emergencies before I get on the trail	1	2	3	4	5	6	7
b. Scheduling a visit to avoid times of high use	1	2	3	4	5	6	7
c. Staying on designated or established trails	1	2	3	4	5	6	7
d. Walking single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	1	2	3	4	5	6	7
g. Avoiding approaching, feeding, or following wildlife	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	1	2	3	4	5	6	7
i. Keeping the footprint of gear and crash pads to a minimum while at the crag	1	2	3	4	5	6	7
j. Playing music at a level that only you, or your immediate group can hear it	1	2	3	4	5	6	7
k. Carrying crash pads out of the park each time you exit	1	2	3	4	5	6	7
l. Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	1	2	3	4	5	6	7
m. Removing tick marks when done bouldering	1	2	3	4	5	6	7
n. Leaving existing lichen, moss, or plants intact at boulder problems	1	2	3	4	5	6	7
o. Placing gear and crash pads on durable surfaces	1	2	3	4	5	6	7
p. Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	1	2	3	4	5	6	7

17. The same activities are listed below. **PART 1**: In COLUMN A tell us if you DO each activity by circling *Never*, *Sometimes*, or *Always*. **PART 2**: In COLUMN B, please indicate how LIKELY you are to do the activity in the future by circling the number of your response for each statement. (*please circle only one number*)	COLUMN A			COLUMN B How likely are you to do this in the future?						
				Very Unlikely	Unlikely	Somewhat Unlikely	Neutral	Somewhat Likely	Likely	Very Likely
Activities	Do You Do This Now?			↓	↓	↓	↓	↓	↓	↓
a. Preparing for all types of weather, hazards, or emergencies before	Never	Sometimes	Always	1	2	3	4	5	6	7
b. Scheduling a visit to avoid times of high use	Never	Sometimes	Always	1	2	3	4	5	6	7
c. Staying on designated or established trails	Never	Sometimes	Always	1	2	3	4	5	6	7
d. Walking single file in the middle of the trail, even when wet or muddy	Never	Sometimes	Always	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	Never	Sometimes	Always	1	2	3	4	5	6	7
f. Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	Never	Sometimes	Always	1	2	3	4	5	6	7
g. Avoiding approaching, feeding, or following wildlife	Never	Sometimes	Always	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	Never	Sometimes	Always	1	2	3	4	5	6	7
i. Keeping the footprint of gear and crash pads to a minimum while at the crag	Never	Sometimes	Always	1	2	3	4	5	6	7
j. Playing music at a level that only you, or your immediate group can hear it	Never	Sometimes	Always	1	2	3	4	5	6	7
k. Carrying crash pads out of the park each time you exit	Never	Sometimes	Always	1	2	3	4	5	6	7
l. Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	Never	Sometimes	Always	1	2	3	4	5	6	7
m. Removing tick marks when done bouldering	Never	Sometimes	Always	1	2	3	4	5	6	7
n. Leaving existing lichen, moss, or plants intact at boulder problems	Never	Sometimes	Always	1	2	3	4	5	6	7
o. Placing gear and crash pads on durable surfaces	Never	Sometimes	Always	1	2	3	4	5	6	7
p. Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	Never	Sometimes	Always	1	2	3	4	5	6	7

18. How much of a problem do you think each of the following issues are at Rocky Mountain National Park. (*Circle the number of your response for each statement*)	Not a Problem	Minor Problem	Moderate Problem	Major Problem	Don't Know/ No Opinion
a. Vegetation loss at the base of boulders	1	2	3	4	DK
b. Excessive chalk and tick marks on boulders	1	2	3	4	DK
c. Moving rocks, trees, or shrubs at the base of boulders to develop safer landing zones	1	2	3	4	DK
d. Hearing music being played through external speakers	1	2	3	4	DK
e. Stashing crash pads for later use	1	2	3	4	DK
f. The presence of human waste near trails or bouldering sites	1	2	3	4	DK
g. The presence of trash at bouldering sites	1	2	3	4	DK
h. Excessive social trails leading to bouldering sites	1	2	3	4	DK
i. Crowding at bouldering sites	1	2	3	4	DK
j. Park visitors stopping me to ask what my crash pad is used for	1	2	3	4	DK

19. Are you familiar with outdoor bouldering ethics? *(please check one)* ☐ No ☐ Yes

If yes, how/where were you introduced to outdoor bouldering ethics? *(write in response below)*

17. The same activities are listed below. **PART 1**: In COLUMN A tell us if you DO each activity by circling *Never*, *Sometimes*, or *Always*. **PART 2**: In COLUMN B, please indicate how LIKELY you are to do the activity in the future by circling the number of your response for each statement. (*please circle only one number*)	COLUMN A			COLUMN B How likely are you to do this in the future?						
				Very Unlikely	Unlikely	Somewhat Unlikely	Neutral	Somewhat Likely	Likely	Very Likely
Activities	Do You Do This Now?			↓	↓	↓	↓	↓	↓	↓
a. Preparing for all types of weather, hazards, or emergencies before	Never	Sometimes	Always	1	2	3	4	5	6	7
b. Scheduling a visit to avoid times of high use	Never	Sometimes	Always	1	2	3	4	5	6	7
c. Staying on designated or established trails	Never	Sometimes	Always	1	2	3	4	5	6	7
d. Walking single file in the middle of the trail, even when wet or muddy	Never	Sometimes	Always	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	Never	Sometimes	Always	1	2	3	4	5	6	7
f. Leaving all natural objects in the area, including rocks, plants, sticks, or feathers	Never	Sometimes	Always	1	2	3	4	5	6	7
g. Avoiding approaching, feeding, or following wildlife	Never	Sometimes	Always	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	Never	Sometimes	Always	1	2	3	4	5	6	7
i. Keeping the footprint of gear and crash pads to a minimum while at the crag	Never	Sometimes	Always	1	2	3	4	5	6	7
j. Playing music at a level that only you, or your immediate group can hear it	Never	Sometimes	Always	1	2	3	4	5	6	7
k. Carrying crash pads out of the park each time you exit	Never	Sometimes	Always	1	2	3	4	5	6	7
l. Leaving existing rocks, trees, or shrubs intact at the base of boulder problems	Never	Sometimes	Always	1	2	3	4	5	6	7
m. Removing tick marks when done bouldering	Never	Sometimes	Always	1	2	3	4	5	6	7
n. Leaving existing lichen, moss, or plants intact at boulder problems	Never	Sometimes	Always	1	2	3	4	5	6	7
o. Placing gear and crash pads on durable surfaces	Never	Sometimes	Always	1	2	3	4	5	6	7
p. Depositing solid human waste in "cat holes", away from water, bouldering areas, and trails	Never	Sometimes	Always	1	2	3	4	5	6	7

18. How much of a problem do you think each of the following issues are at Rocky Mountain National Park. (*Circle the number of your response for each statement*)	Not a Problem	Minor Problem	Moderate Problem	Major Problem	Don't Know/ No Opinion
a. Vegetation loss at the base of boulders	1	2	3	4	DK
b. Excessive chalk and tick marks on boulders	1	2	3	4	DK
c. Moving rocks, trees, or shrubs at the base of boulders to develop safer landing zones	1	2	3	4	DK
d. Hearing music being played through external speakers	1	2	3	4	DK
e. Stashing crash pads for later use	1	2	3	4	DK
f. The presence of human waste near trails or bouldering sites	1	2	3	4	DK
g. The presence of trash at bouldering sites	1	2	3	4	DK
h. Excessive social trails leading to bouldering sites	1	2	3	4	DK
i. Crowding at bouldering sites	1	2	3	4	DK
j. Park visitors stopping me to ask what my crash pad is used for	1	2	3	4	DK

19. Are you familiar with outdoor bouldering ethics? *(please check one)* ☐ No ☐ Yes

If yes, how/where were you introduced to outdoor bouldering ethics? *(write in response below)*

20. How would you describe your current level of knowledge of "Leave No Trace" practices? *(circle one number)*

No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
0	1	2	3	4	5	6

21. Please indicate how strongly you DISAGREE or AGREE with the following statements. *(Circle the number of your response for each statement)*	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree		
a. Practicing "Leave No Trace" is time consuming	1	2	3	4	5	6	7
b. Practicing "Leave No Trace" limits my freedom in the outdoors	1	2	3	4	5	6	7
c. Practicing "Leave No Trace" protects the environment	1	2	3	4	5	6	7
d. It is important that all visitors practice "Leave No Trace"	1	2	3	4	5	6	7
e. It is important that park regulations require all visitors to practice "Leave No Trace"	1	2	3	4	5	6	7
f. I insist that "Leave No Trace" practices are followed by all members of my group	1	2	3	4	5	6	7
g. I practice "Leave No Trace" because the people I recreate with believe it is important	1	2	3	4	5	6	7
h. If informed that my actions in the Park damaged the environment, I would change my behavior	1	2	3	4	5	6	7
i. Rocky Mountain National Park means a lot to me	1	2	3	4	5	6	7
j. I enjoy bouldering in Rocky Mountain National Park more than any other place	1	2	3	4	5	6	7
k. I feel no commitment to Rocky Mountain National Park	1	2	3	4	5	6	7
l. I am very attached to Rocky Mountain National Park	1	2	3	4	5	6	7
m. Bouldering in Rocky Mountain National Park is more important to me than bouldering in any other place	1	2	3	4	5	6	7

22. How did the number of people you saw bouldering during your visit compare with what you expected? *(check one)*

- ☐ A lot less than what you expected
- ☐ A little less than what you expected
- ☐ About what you expected
- ☐ A little more than what you expected
- ☐ A lot more than what you expected
- ☐ You did not have any expectations

23. How crowded did you feel while bouldering at Rocky Mountain National Park today? *(circle one number)*

Not at all crowded	Slightly crowded	Moderately crowded	Very crowded	Extremely crowded
1	2	3	4	5

24. How did the number of other boulderers you encountered affect your overall experience today? *(circle one number)*

Added greatly	Added somewhat	Had no effect	Detracted somewhat	Detracted greatly
1	2	3	4	5

25. Did you move to a different crag/boulder based on the number of people you encountered? *(check one)* ☐ No ☐ Yes

26. What did you like LEAST about your bouldering experience at Rocky Mountain National Park today? *(write in answer)*

_____

27. What did you like MOST about your bouldering experience at Rocky Mountain National Park today? *(write in answer)*

_____

28. What is your gender? *(check one)* ☐ Female ☐ Male

29. What is your age *(write in number of years)*: _____

30. Do you live in the United States? *(check one and fill in)*:

- ☐ Yes - What is your zip code? _____
- ☐ No - In what country do you live? _____

Rocky Mountain National Park and Pennsylvania State University thank you for your assistance.

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Survey #:	Date:	Time:	Initials:	Location: EL LH WB

20. How would you describe your current level of knowledge of "Leave No Trace" practices? *(circle one number)*

No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
0	1	2	3	4	5	6

21. Please indicate how strongly you DISAGREE or AGREE with the following statements. *(Circle the number of your response for each statement)*	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree		
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28. What is your gender? *(check one)* ☐ Female ☐ Male

29. What is your age *(write in number of years)*: _____

30. Do you live in the United States? *(check one and fill in)*:

- ☐ Yes - What is your zip code? _____
- ☐ No - In what country do you live? _____

Rocky Mountain National Park and Pennsylvania State University thank you for your assistance.

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Survey #:	Date:	Time:	Initials:	Location: EL LH WB

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The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS XXXXXX, Month Year (The Fort Collins Support Office will fill out this line for you)

National Park Service
U.S. Department of the Interior

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