

EVALUATING PERSUASIVE MESSAGES TO INFLUENCE DOG LEASH LAW COMPLIANCE AT A PUBLIC AREA IN THE GREAT PLAINS

Joel G. Jorgensen^{1*} & Mary Bomberger Brown²

¹*Nongame Bird Program, Nebraska Game and Parks Commission, Lincoln, NE, 68503, 402-471-5440,*

joel.jorgensen@nebraska.gov;

²*Tern and Plover Conservation Partnership, School of Natural Resources, University of Nebraska–Lincoln,*

Lincoln, NE, 68583, 402-472-8878, mbrown9@unl.edu

*Corresponding author

ACKNOWLEDGEMENTS

We thank Lauren Dinan, Jamie Briske, Lindsay Brown, Peyton Burt, Chris Chizinski, Tiffany Riffle, Zach Schafer, and Jessica Tramp for their assistance on this project. We thank the individuals and agencies that assisted us including Cedar Point Biological Station, Central Nebraska Public Power and Irrigation District, Nebraska Game and Parks Commission [parks, law enforcement and wildlife divisions], U.S. Fish and Wildlife Service, Colby Johnson, Karie Decker, Mark Peyton, and Gabe Wilson. Funding for this project was provided by the U.S. Fish and Wildlife Service and the Nebraska Game and Parks Commission under Nebraska State Wildlife Grant T-78-R3. Additional support provided by the Nebraska Environmental Trust, Nebraska Wildlife Conservation Fund, and University of Nebraska–Lincoln School of Natural Resources. We also thank two anonymous reviewers whose comments greatly improved the manuscript.

EVALUATING PERSUASIVE MESSAGES TO INFLUENCE DOG LEASH LAW COMPLIANCE AT A PUBLIC AREA IN THE GREAT PLAINS

ABSTRACT. Visitors to public recreation areas where dogs are permitted often choose not to place their pets on leashes despite the presence of enforceable leash law regulations. Unleashed dogs can impact the safety of visitors, wildlife, and the environment and burden managers with additional duties. Often, improving leash law compliance is considered a law enforcement issue rather than a behavior that can be modified through education. We tested several persuasive messages addressing leash law compliance at a public recreation area in western Nebraska, where visitors are allowed to be accompanied by dogs. The area is an important nesting area for a legally-protected shorebird, the Piping Plover (*Charadrius melodus*); unleashed dogs in plover nesting areas present a serious concern for managers. The majority of dog owners (81.3%) was aware of existing leash law regulations and expressed a high likelihood (4.13/5) of leashing their pet even though observations showed chronically low (16%) compliance rates. Urban and rural visitors perceived persuasive messages similarly. A persuasive message that emphasized avoiding dog bites and fights was the most likely to persuade dog owners to leash their pets. An education campaign focusing on this message may be helpful in improving leash law compliance in public recreation areas.

KEYWORDS. dog leashing; education; persuasion; piping plover; recreation management; threatened and endangered species

INTRODUCTION

Addressing impacts to the environment caused by visitors' behavior is a considerable challenge for resource agencies managing public lands for recreation. Of particular concern are dog owners who allow their pets to be unleashed despite the presence of enforceable leash law regulations (Forrest and Clair 2006). In some settings, unleashed dogs may only be a nuisance, but in others unleashed dogs can foul the water and land with their waste, cause injury or the threat of injury to people and other dogs, and negatively impact wildlife (Foster 2006; Weston and Stankowich 2013). Unleashed dogs can negatively impact shorebirds that place their nests on expanses of sand adjacent to water, such as beaches and river sandbars. During the nesting season, unleashed dogs may kill or

injure adults and chicks, destroy nests and eggs, displace birds from important habitats, and alter breeding or foraging behaviors (Burger 1981; Lafferty et al. 2006; Weston and Elgar 2007; Jorgensen and Brown 2016).

The Northern Great Plains population of Piping Plover is a legally-protected, state and federally threatened shorebird that nests and raises its young on public beaches (Jorgensen and Brown 2016), lakeshore housing developments (Brown et al. 2010), and river sandbars (USFWS 1988) – areas that are also attractive to and intensively used by people, who are frequently accompanied by dogs, for recreation. In the past, the number of recreationists at public sites used by Piping Plovers for nesting in the more sparsely populated parts of the Great Plains was relatively low and direct impacts to birds were limited. However, in recent years, recreational use has increased dramatically and with it the number of plover-people (dog) conflicts (Jorgensen and Brown 2014). This dynamic can be attributed to the changing distribution and mobility of human populations in the Great Plains. Much of the region, including areas that harbor popular public recreation destinations, have experienced depopulation and the majority of human populations are now clustered in relatively nearby urban areas (Nickels and Day 1997; Curtis White 2008). Large influxes of urban-based people to rural recreation areas can stress or exceed the capacity of local services to manage the impact (Weber et al. 2014). This may result in relatively minor offenses, such as the presence of unleashed dogs, not being addressed by law enforcement.

Regulatory agencies and conservation practitioners are placing increased emphasis on improving leash law compliance to avoid negative impacts to legally protected species caused by unleashed dogs. In the case of Piping Plovers, increased law enforcement is the action identified to improve leash law compliance in federal Endangered Species Act (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) recovery plans (USFWS 1988, 1994, 1996). In some instances, agencies managing public recreation areas are required to address leash law compliance in order to comply with the federal Endangered Species Act. Public engagement programs to address dog leashing are not specified in these recovery plans. The reliance on law enforcement does not encourage managers to evaluate the reasons why visitors choose to not leash their dogs and work to modify the behavior.

The causes of visitors' undesirable behaviors on public lands are variable and there is unlikely to be a single cause for any of these behaviors (Dawson and Hendee 2009). For example, residents of rural areas are known to hold different attitudes toward the role of government (Scala et al. 2015), outdoor recreation (Hendee 1969), environmental issues (Williams and Moore 1991, Berenguer et al. 2005), and animals (Kellert 1985) than residents

of urban areas. It is important to identify and understand the different origins of behaviors in different demographic groups to better address them using the full range of available tools (Dawson and Hendee 2009).

Theories of Reasoned Action and Planned Behavior and Persuasive Messaging

Dawson and Hendee (2009) identified five types of undesirable human behaviors: careless, unskilled, uniformed, unavoidable, and illegal. Actions that can be implemented on public lands to reduce these undesirable behaviors, and the associated negative consequences, fall into four categories: regulation, enforcement, site management, and education (Marion and Reid 2007). All four types of action have costs and benefits and every situation will require a remedy with a different balance of the four actions. Adding regulations may be undesirable if the public perceives them as limiting freedom of action. Enforcement of laws and regulations is labor intensive, expensive, and punishes visitors for bad behavior rather than encouraging good behavior. Site management may alter visitors' experiences, be expensive, and may only be effective at reducing certain types of undesirable behaviors. Education programs are inexpensive and effective in situations where visitors do not possess information about the negative consequences of their behaviors. Visitor education programs are not perceived as being as heavy-handed at reducing unwanted behaviors as regulation, enforcement or site management. When properly developed, education programs can change human behaviors by providing a cognitive basis for doing so (Marion and Reid 2007).

To be successful, education programs must be based on sound principles of how information can influence existing attitudes and behaviors (Marion and Reid 2007). Fishbein and Ajzen's (1975) theory of reasoned action and its extension, the theory of planned behavior (Ajzen 1985), are useful in explaining human actions. The theory of reasoned action posits behaviors are based on an individual's intentions regarding the likelihood a behavior will lead to an expected outcome; intentions are formed by attitudes and subjective norms. Attitudes are instructed by personal and normative beliefs (expectations of others) and form the subjective norm (perceived social pressure) about performing the behavior. The combination of attitude, subjective norm, and intention result in the performance of a behavior.

One goal of education programs is to persuade people to alter their behaviors. Persuasion uses informative messages to alter people's beliefs, attitudes, and norms to influence their intentions and behaviors (Ajzen 1992). A persuasive message consists of three components, 1) a position on an issue, 2) arguments which support the position, and 3) factual evidence which supports the arguments. Persuasive messaging has not been frequently used in public lands management even though agencies and managers often need to achieve behavioral change with their visitors

(Schroeder et al. 2012). In the few instances in which persuasive messaging has been used, it has proven successful (Fishbein and Manfredo 1992; Warren et al. 2016). For example, persuasive messaging reduced the undesirable behavior of not paying an entrance fee at a public area by up to 50% (Steckenreuter and Wolf 2013).

Effective persuasive messages, 1) include factual information, 2) focus on personal or social values or norms, 3) originate from a credible source, 4) make moral or fear-based appeals, 5) are delivered as narratives with questions (i.e., begin with how or why and suggest behaviors to replace the undesirable behavior), 6) may include qualifiers or counter arguments, and 7) may be one-sided (Schroeder et al. 2012). An education program intended to improve public behavior (e.g., leash law compliance) will likely need to be part of a broader, long-term, initiative that includes other actions (e.g., enforcement).

Very few studies (Nesbitt 2006; Williams et al. 2009; Jorgensen and Brown 2014) have examined leash law noncompliance on public lands. Nesbitt (2006) surveyed visitors to a state park in North Carolina who were accompanied by dogs and found nearly 76% were aware the park had a leash law, but 48% allowed their dogs to be unleashed; 15% of visitors with unleashed dogs agreed with the statement “it is my choice how I walk my dog”. Nesbitt (2006) and Williams et al. (2009) found most visitors with dogs believed violating the leash law had few or no negative consequences, others were unaware of the possible damage caused by their dog, and some willfully defied enforcement. Williams et al. (2009) also found dog owners generally did not believe their dog’s behavior could have negative consequences even when they believed dogs generally could result in negative consequences. Nesbitt (2006) suggested the optimal approach to reduce unwanted behaviors was through persuasive messaging.

This Study

The purpose of this study was to identify persuasive messaging which could be used in a high impact, cost-effective education program addressing leash law compliance at a public recreation area in western Nebraska and whether specific messages may be more impactful toward different demographic groups (e.g., rural and urban residents). Existing education infrastructure (e.g., signs) and education efforts (e.g., flyers distributed at entrance booths) at our study area passively inform visitors that a leash law regulation is in place (NGPC, pers. comm.). Our study goal was to determine the persuasive messages most likely to influence attitudes and behaviors toward leash law compliance. Our specific objectives were to, 1) examine the influence of different persuasive messages on dog owners’ attitudes and intentions towards observing the leash law and 2) evaluate non-dog owners’ attitudes toward the presence and enforcement of the leash law.

METHODS

Our study took place at Lake McConaughy, Keith County, Nebraska, USA, from June 12 to July 8, 2016. Lake McConaughy exists in a complex state and federal regulatory and management environment. Lake McConaughy (41°14'09.6"N, 101°44'27.0"W) is a reservoir formed by the closing of Kingsley Dam on the North Platte River in 1941 (CNPPID 2009) with the intention of providing water for crop irrigation. The dam supports a hydroelectric power generating facility operated under Federal Energy Regulatory Commission (FERC) license No. 1417 issued in 1998 (CNPPID 2009). License conditions require the Central Nebraska Public Power and Irrigation District (CNPPID) to manage and protect threatened and endangered species listed under the Endangered Species Act and to provide recreational opportunities for the public in addition to providing water for irrigation (CNPPID 2009). The area surrounding the lake is leased to the Nebraska Game and Parks Commission, which manages public recreation (e.g., camping, fishing, swimming and boating). The lake is ringed by broad sandy beaches making this public area attractive to human visitors and nesting Piping Plovers. Piping Plovers nest on the beaches of Lake McConaughy from late April through early August, a period when recreational use is most intense (as many as 1 million per year; NGPC, pers. comm.). According to state regulations, dogs are permitted at Lake McConaughy if they are restrained by a leash of six feet or less in length (Nebraska Administrative Code Title 163, Chapter 5, Section 001). Leash law compliance was low (16%) when evaluated from 2013-2014 (Jorgensen and Brown 2014) and addressing leash law noncompliance at Lake McConaughy has not been emphasized until recently because of other priorities and resource limitations due to large influx of visitors during the summer.

Our methods follow those used by Jorgensen and Brown (2014, 2015, 2016). Two trained assistants conducted personal interview surveys of visitors on the beaches and upper shoreline area of Lake McConaughy. For basic demographic information, we asked survey respondents their sex, age, zip code of primary residence, and number of annual visits to Lake McConaughy. We measured respondents' awareness by asking whether they were aware of the leash law. We determined their attitude toward the leash law by asking whether they supported or opposed the existing leash law. We measured dog owner's behavioral intention toward leashing their pet by asking if they intended to leash their dog when visiting Lake McConaughy. We then presented seven different persuasive messages designed to increase dog owners' likelihood of leashing their pet and asked whether the message changed their support or opposition to the leash law. We asked survey respondents to, 1) judge the factual content of the

message and 2) answer if they agreed or disagreed with the message. The seven messages and codes used to refer to specific questions throughout the remainder of the manuscript are within brackets and are as follows: (1) [LEASH LAW] Nebraska Game and Parks Commission regulations have a leash law in place at Lake McConaughy, (2) [PEER] The majority of visitors to Lake McConaughy favor having dogs on the beaches leashed, (3) [HARM WILDLIFE] Scientific studies have shown unleashed dogs can harm native wildlife. Unleashed dogs are known to harm Piping Plover chicks, a threatened shorebird which nests on the sandy beaches of Lake McConaughy, (4) [CITATION] Having an unleashed dog can result in a citation and monetary fine, (5) [REGULATION] High numbers of unleashed dogs may result in a change in regulations which would not allow dogs on beach, (6) [SAVE MONEY] Leashing your dog will help agencies spend less time and money on enforcement, reduce fellow recreationists' concerns about unleashed dogs, and reduce risks to wildlife, (7) [PREVENT BITES] Leashing your dog will prevent dogs from wandering into other people's campsites and possibly avoid dog bites and dog fights.

The [LEASH LAW] statement served as our control because it is factually correct and is stated on information signs placed at lake access points. Responses to all statements were scored on the Likert Scale (1-5) with 1 being least likely, 3 neutral, and 5 most likely (Likert 1931). We asked, 1) respondents accompanied by a dog, whether participating in the survey made them more likely, less likely or did not change their likelihood of leashing their dog and 2) respondents not accompanied by a dog, whether participating in the survey increased, decreased or did not change their support for the leash law. Responses were recorded numerically as 1 (more likely), 0 (did not change) or -1 (less likely). A positive response indicated a message made respondent more likely to leash their dog (or increase their support for the law) while a negative response indicated a message made respondent less likely to leash their dog (or decrease their support for the law).

We used Fisher's exact test and chi-squared test of independence to determine whether the distribution of responses to statements differed by respondents' demographic characteristics. We used Fisher's exact test when a response category had fewer than five total responses. We used a Kruskal-Wallis test to determine whether the distribution of responses to statements differed by the location of the respondent's primary residence. We used one-way ANOVA to determine whether the distribution of responses were different for the reasons dog owners chose to leash or not leash their dog. All analyses were completed using RStudio (RStudio Team 2015). We followed Jorgensen and Brown (2015) and defined "local residents" as those with a home zip code located within an 80 km radius of Lake McConaughy; "FRUC residents" as those with zip codes within the Front Range Urban Corridor

(FRUC) that extends from Colorado Springs, Colorado, to Cheyenne, Wyoming; “other Nebraska residents” as those with home zip codes located further than 80 km from Lake McConaughy; “other Colorado residents” as those that are not local (within 80 km) or FRUC residents, and “other respondents” (Figure 1). We considered all resident from the FRUC as urban residents and all others as rural residents based on their home zip code locations.

All survey questions and the survey protocol were evaluated and approved by the University of Nebraska–Lincoln Institutional Review Board (UNL IRB#20130213371EX research approval certificate). University of Nebraska–Lincoln Human Research/Social & Behavioral training, Responsible Conduct of Research training, and IRB training were completed before all research was conducted.

RESULTS

We asked 274 people to complete the survey, only 17 individuals declined to participate for an overall response rate of 94% (n = 257). During the study, not all survey respondents answered all questions and, rarely, responses were not properly recorded on our electronic tablets due to technical or human error. A total of 126 females (49.0%), 131 males (51.0%) were surveyed. Respondents’ ages ranged from 19 to 84 years with an average age of 44.0 ± 0.9 . Of the 257 respondents, the majority were from the FRUC (54.5%, n = 140) followed by residents from the local area (23.3%, n = 60), other areas of Nebraska (12.4%, n = 32), other areas of Colorado (5.4%, n = 14) and other (4.3%, n = 11). Thus, 54.5% (n = 140) of survey respondents were considered urban residents and 45.5% (n = 117) were considered rural residents. We assume this distribution is representative of all visitors to Lake McConaughy. Respondents made an average of 11.0 ± 1.9 visits per year to Lake McConaughy. More visitors (58.4%, n = 150) did not have a dog accompanying them than those that were accompanied by a dog (41.6%, n = 107).

Of the 257 respondents, most (68.8%, n = 177) were aware of the leash law at Lake McConaughy. A higher percentage of visitors with dogs (81.3%, n = 87) were aware of the leash law than visitors without dogs (60.0%, n = 90); the difference was significant ($\chi^2 = 12.25$, df = 1, $P < 0.001$). Support for the leash law was positive for all visitors combined (3.73 ± 0.06), and for visitors with dogs (3.64 ± 0.08) and visitors without dogs (3.79 ± 0.08); the difference was not significant (Fisher’s exact test; $P = 0.31$).

Visitors with dogs expressed a strong likelihood of leashing their dogs (4.13 ± 0.12) even when they did not support the leash law. The distribution of responses for support of the leash law did not differ by sex ($\chi^2 = 8.11$, df = 8, $P < 0.42$). Visitors who were local residents or residents from Colorado (not FRUC) indicated a higher level of support (4.07 ± 0.07 , 4.07 ± 0.22 , respectively) for the leash law compared to visitors who were residents of other

areas in Nebraska (3.72 ± 0.16), other (3.73 ± 0.24), or the FRUC (3.57 ± 0.07); the difference was significant (Kruskal-Wallis test; $H = 12.79$, $df = 4$, $P = 0.01$) suggesting rural residents were more supportive of the law than urban residents. The likelihood of leashing a dog was not different by respondents' sex ($\chi^2 = 4.33$, $df = 4$, $P < 0.36$) or location of primary residence (Kruskal-Wallis test; $H = 3.22$, $df = 4$, $P = 0.52$).

Their own dog's safety was considered a more important factor (4.56 ± 0.09) influencing an owner's decision to leash their dog than the attitudes or opinions of other beach visitors (4.00 ± 0.11), awareness of the leash law (3.99 ± 0.11) or possible consequences (e.g., citations or fines) of not leashing their dog (3.18 ± 0.14). The ANOVA results showed the distribution of responses among factors were different ($F_{3,424} = 25.13$, $P < 0.001$). Post hoc analyses using Tukey's HSD using pairwise comparisons showed all but awareness of the leash law and opinions of other beach visitors ($P = 0.99$) were different (all other P 's < 0.004).

Among all persuasive messages, the majority of visitors, both with and without dogs, accepted all but one message [REGULATION] as factually accurate. The highest proportion (96.5%, $n = 250$) of all respondents accepted [PREVENT BITES] as factually correct, followed by [LEASH LAW] (88.7%, $n = 255$), [HARM WILDLIFE] (75.1%, $n = 255$), [CITATION] (73.1%, $n = 255$), [SAVE MONEY] (70.0%, $n = 255$), [PEER] (51.0%, $n = 255$) and [REGULATION] (46.7%, $n = 255$). There was no difference in responses between rural and urban residents (Figure 2; all P s > 0.32).

A majority of visitors, both with and without dogs, agreed with all but one of the persuasive message statements [REGULATION]. The highest proportion (87.8%, $n = 244$) of all respondents agreed with the persuasive message statement [PREVENT BITES], followed by [LEASH LAW] (80.0%, $n = 255$), [HARM WILDLIFE] (70.3%, $n = 246$), [CITATION] (71.2%, $n = 250$), [SAVE MONEY] (69.4%, $n = 242$), [PEER] (68.2%, $n = 255$) and [REGULATION] (34.0%, $n = 250$). There was no difference in responses between rural and urban residents (Figure 3; all P 's > 0.22).

Exposure to all persuasive messages resulted in dog owners stating they were more likely to leash their dogs. The message [PREVENT BITES] scored the highest (0.24 ± 0.04 , possible range -1 to 1) followed by [HARM WILDLIFE] (0.23 ± 0.04), [LEASH LAW] (0.22 ± 0.04), [REGULATION] (0.20 ± 0.04), [CITATION] (0.19 ± 0.04), [PEER] (0.14 ± 0.03), and [SAVE MONEY] (0.11 ± 0.03). Exposure to all persuasive messages had less impact on respondents without dogs and only slightly increased their support for the leash law. The message [LEASH LAW] scored the highest (0.07 ± 0.02) among respondents without dogs, followed by [PREVENT BITES]

(0.06 ± 0.02), [REGULATION] (0.03 ± 0.02), [HARM WILDLIFE] (0.02 ± 0.01), [CITATION] (0.02 ± 0.01), [PEER] (0.01 ± 0.01), and [SAVE MONEY] (0.01 ± 0.01).

Respondents accompanied by dogs stated they were more likely (0.22 ± 0.04 , possible range -1 to 1) to leash their dogs after completing the survey. Individuals without dogs stated they were more likely (0.25 ± 0.04 , possible range -1 to 1) to support the leash law after completing the survey.

DISCUSSION

High impact, cost-effective education campaigns employing persuasive messages can be effective in managing undesirable human behaviors in public areas (Steckenreuter and Wolf 2013). Low compliance rates with dog leash laws are an example of undesirable behavior that can result in serious consequences to people, pets, and wildlife. Achieving a better understanding of the causes of low compliance rates is a necessary foundation for an effective education campaign. In this study, we asked rural- and urban-based visitors to a public recreation area with chronically low compliance rates to evaluate persuasive messages that could be used in an education campaign to convince visitors to leash their dogs.

The majority of survey respondents was aware of and supported the leash law independent of whether or not they leashed their own dog or owned a dog. Rural residents were more supportive of the leash law than were urban residents. These results suggest visitors to Lake McConaughy would be receptive to a leash law education campaign. Williams et al. (2009) showed a similar pattern of dog owners stating a strong commitment to leash their dog in contrast to what was actually observed. They attributed this discrepancy to the fact that personal norms may not translate into a behavior because other norms interfere. Survey respondents may have exaggerated their responses to appear in a positive light (Williams et al. 2009); this may be the case in our study, but we are not able to evaluate that possibility.

The persuasive message [PREVENT BITES] received the most support of our seven messages. The majority of respondents agreed with the statement and believed it was factually correct. Dog owners indicated this message was more effective than the mere existence of a leash law [LEASH LAW] and the one most likely to persuade them to leash their dogs while visiting Lake McConaughy. Dog bites and fights regularly occur in situations where dogs and people are in close proximity (Harris et al. 1974) and children are often injured in these situations (Beck and Jones 1985); dog bites and fights occur with some regularity at Lake McConaughy (NGPC,

pers. comm.). Dog owners' awareness of the personal harm, and medical and legal consequences, of their dog biting someone or being injured in a fight is a reasonable explanation for why dog owners were more receptive to this message. A potential barrier to leashing is that owners believe their own dogs are harmless while others dogs have the potential to be dangerous (Williams et al. 2009). Similar comments were received from respondents during and following completion of our survey. Recognizing the tendency of dog owners to avoid assigning negative behaviors to their own pet would be important in developing this message further as part of an education campaign (Festinger 1975).

The persuasive messages [HARM WILDLIFE], [CITATION], and [SAVE MONEY] were considered by dog owners to be factually correct but agreed to by fewer respondents than the control message [LEASH LAW]. Two of these messages, [HARM WILDLIFE] and [SAVE MONEY], are altruistic in nature and emphasize a benefit to someone or something other than the dog owner. [PREVENT BITES] is both altruistic and selfish in nature, there is a benefit both to someone or something else and to the dog owner, which may help explain its' effectiveness. [CITATION] is the only message emphasizing a direct negative consequence (monetary fine) to a dog owner that fared well in our survey. The messages [PEER] and [REGULATION] were considered factually correct and agreed to by the smallest proportion of dog owners and unlikely to be highly effective in an education campaign. We found no evidence that different messages were perceived differently by, or could be more effective than other messages, when directed toward rural or urban residents.

The persuasive messages presented during the survey resulted in dog owners expressing their intention to leash their dogs. Our messages had minimal influence on changing the support for the leash law by respondents without dogs. This result was somewhat unexpected since respondents without dogs do experience the negative consequences (e.g., dog bites) of unleashed dogs. However, visitors without dogs do not experience either the positive consequences of unleashed dogs (e.g., playing with the dog) or the negative consequences of having their unleashed pet bite someone. We feel exposing dog owners to these persuasive messages, as well as engaging them in personal conversations, increased the likelihood that they would leash their dogs. This suggests that an education campaign has the potential to improve leash law compliance rates at Lake McConaughy and other recreation areas.

Low-impact education campaigns are unlikely by themselves to quickly improve leash law compliance rates. They will need to be conducted in concert with a law enforcement campaign to be most effective in the shortest amount of time. In our study, the risk of a citation or fine was not considered persuasive simply because

dog owners did not expect it to happen. This is likely due to the fact that leash law enforcement has not been a major focus in the years prior to this study due to resource limitations (NGPC, pers. comm.). During this study, law enforcement personnel increased their focus on leash law noncompliance and overall compliance increased from 16% in 2013-2014 to 67% in 2016. We expect that a low-impact education campaign conducted in concert with law enforcement will be necessary until leashing dogs becomes the social norm at Lake McConaughy.

Our results differ somewhat from other studies (Christensen and Cole 2000; Hendricks et al. 2001). Those studies demonstrated that ecological reasons, for example, damage to the environment from camping and mountain bicycle riding, rather than social reasons were more likely to persuade visitors to alter their behavior. Our study showed a social reason, preventing consequences of dog bites and fights, as being more persuasive to dog owners than the ecological reason of protecting wildlife, including threatened and endangered species. In our study, the message of leashing dogs to avoid dog bites and fights aligned most closely with the most important reason, their dog's safety, for why dog owners told us they chose to leash their dog.

Our study was limited because we only evaluated the content of persuasive messages; we did not evaluate the method of message delivery. While message content is undeniably important, message delivery plays a key role in determining whether messages are effective in achieving the desired outcome of behavioral change (Marion and Reid 2007). Threatening messages or ones that emphasize disapproval of behaviors (proscriptive) are less likely to succeed than those that emphasize approval of behaviors (prescribed; Winter et al. 2000). Additional study is needed to evaluate the optimal mechanisms to deliver effective persuasive messages identified in this study.

The challenges of managing recreation at Lake McConaughy and other sites in the sparsely populated areas of the Great Plains are notable. Lake McConaughy is located in a county and state with relatively small populations of 8,018 and 1.8 million citizens, respectively (census.gov, accessed 30 March 2017), but the lake's close proximity to a large metropolitan area, the Front Range Urban Corridor that includes metropolitan Denver, Colorado, has translated into a major, and increasing, influx of visitors during the short summer recreation season. The number of visitors to Lake McConaughy now exceeds 1 million per year and the number of visitors during holiday weekends can exceed 50,000 (NGPC, pers. comm.). Such large influxes of people can easily exceed the capacity of local services in low population areas, including law enforcement, and minor offenses such as leash law violations are often not addressed simply for lack of resources (Weber et al. 2014). Managers and agencies can help address the challenges associated with high densities of human visitors by using persuasive messaging in targeted education

campaigns to achieve their objectives and limit negative impacts to threatened and endangered species caused by unleashed dogs or other threats.

REFERENCES

- Ajzen, I. 1985. "From intentions to actions: A theory of planned behavior". In *Springer Series in Social Psychology*, ed. J. Kuhl and J. Beckmann, 11–39. Berlin:Springer Publishing.
- Ajzen, I. 1992. "Persuasive communication theory in social psychology: A historical perspective." In *Influencing human behaviour*, ed. M. J. Manfredi, 1-28. Champaign, IL: Sagamore Publishing
- Beck, A. M., and Jones, B. A. (1985). Unreported dog bites in children. *Public Health Reports*, 100: 315-321.
- Berenguer, J., Corraliza, J. A., & Martin, R. 2005. "Rural-urban difference in environmental concern, attitudes, and actions." *European Journal of Psychological Assessment* 21: 128-138.
- Brown, M.B., M.E. Burbach, J. Dinan, R.J. Held, R.J. Johnson, J.G. Jorgensen, J. Lackey, J.F. Marcus, G.S. Matkin and C.M. Thody. 2010. "Nebraska's Tern and Plover Conservation Partnership—a model for sustainable conservation of threatened and endangered species." *Wader Study Group Bulletin* 118: 22-25.
- Burger, J. 1981. "The effect of human activity on birds at a coastal bay." *Biological Conservation* 21: 231–241.
- Christensen, N. A., and D. N. Cole. 2000. "Leave no trace practices: behaviors and preferences of wilderness visitors regarding use of cookstoves and camping away from lakes." In *Wilderness science in a time of change conference—Volume 4: Wilderness visitors, experiences, and visitor management*, ed. D.N. Cole, S.F. McCool, W.T. Borrie, and J. O'Loughlin,; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-4. Ogden, UT, 77-85. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Central Nebraska Public Power and Irrigation District (CNPPID). 2009. Land and shoreline management Plan for the Kingsley Dam Project: Federal Energy Regulatory Agency License No. 1417. Central Nebraska Public Power and Irrigation District, Holdrege, NE, USA.
- Curtis White, K.J. 2008. "Population change and farm dependence: Temporal and spatial variation in the US Great Plains, 1900–2000." *Demography* 45: 363-386.
- Dawson, C.P., and J.C. Hendee. 2009. *Wilderness management: Stewardship and protection of resources and values*. Golden, CO: Fulcrum Publishing.

- Festinger, L. 1975. *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.
- Fishbein, M., and I. Ajzen. 1975. *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley.
- Fishbein, M., and M. J. Manfredo. 1992. "A theory of behavior change." In *Influencing Human Behavior: Theory and Applications in Recreation, Tourism and Natural Resources Management*, ed. M. J. Manfredo. Urbana, IL: Sagamore Publishing.
- Forrest, A., and C. C. S. Clair. 2006. "Effects of dog leash laws and habitat type on avian and small mammal communities in urban parks." *Urban Ecosystems* 9: 51–66.
- Foster, L. K. 2006. *Dogs on the beach: a review of regulations and issues affecting dog beaches in California*. Report. California State Library, California Research Bureau, Sacramento, CA.
<http://library.ca.gov/crb/06/06/06-006.pdf>
- Harris, D., P. J. Imperato, and B. Oken. 1974. "Dog bites-an unrecognized epidemic." *Bulletin of the New York Academy of Medicine* 50: 981-1000.
- Hendee, J.C. 1969. "Rural—urban differences reflected in outdoor recreation participation." *Journal of Leisure Research* 7: 256-269.
- Hendricks, W. W., R. H. Ramthun, and D. J. Chavez. 2001. "The effects of persuasive message source and content on mountain bicyclists' adherence to trail etiquette guidelines." *Journal of Park and Recreation Administration* 19: 38–61.
- Jorgensen, J. G., and M. B. Brown. 2014. "Piping Plovers (*Charadrius melodus*) and dogs: compliance with and attitudes toward a leash law on public beaches at Lake McConaughy, Nebraska, USA." *Wader Study Group Bulletin* 121: 7–12.
- Jorgensen, J. G., and M. B. Brown. 2015. "Evaluating recreationists' awareness and attitudes towards Piping Plovers (*Charadrius melodus*) at Lake McConaughy, Nebraska, USA." *Human Dimensions of Wildlife* 20: 367-380.
- Jorgensen, J. G., and M. B. Brown. 2016. "Flight initiation distances of Piping Plovers (*Charadrius melodus*) in response to human disturbance." *Avian Conservation and Ecology* 11(1):5. <http://dx.doi.org/10.5751/ACE-00826-110105>

- Kellert, S. R. 1985. "Attitudes toward animals: Age-related development among children." *Journal of Environmental Education* 16: 29-39.
- Lafferty, K. D., D. Goodman, and C. P. Sandoval. 2006. "Restoration of breeding by Snowy Plovers following protection from disturbance." *Biodiversity and Conservation* 15: 2217-2230.
- Likert, R. 1931. "A technique for the measurement of attitudes." *Archives of Psychology*. New York, NY: Columbia University Press.
- Marion, J. L., and S. E. Reid. 2007. "Minimising visitor impacts to protected areas: the efficacy of low impacts education programmes." *Journal of Sustainable Tourism* 15: 5-27.
- Nesbitt, R. K. 2006. "Toward an understanding of noncompliant behavior in outdoor recreation: linking the theory of planned behavior to off-leash dogs at William B. Umstead State Park." Master's thesis, North Carolina State University, Raleigh, NC.
- Nickels, C.R., and F.A. Day. 1997. "Depopulation of the rural Great Plains counties of Texas." *Great Plains Research* 7: 225-250.
- RStudio Team. 2015. RStudio: Integrated Development for R. RStudio, Inc., Boston, MA; <http://www.rstudio.com/>.
- Scala, D.J., K.M. Johnson, and L.T. Rogers. "Red rural, blue rural? Presidential voting patterns in a changing rural America." *Political Geography* 48: 108-118.
- Schroeder, S. A., D. C. Fulton, W. Penning, and K. Doncarlos. 2012. "Using persuasive messaging to encourage hunters to support regulations of lead shot." *Journal of Wildlife Management* 76: 1528-1539.
- Steckenreuter, A., and I. D. Wolf. 2013. "How to use persuasive communication to encourage visitors to pay park user fees." *Tourism Management* 37: 58-70.
- U.S. Fish and Wildlife Service (USFWS). 1988. *Great Lakes and northern Great Plains Piping Plover recovery plan*. Report. U.S. Fish and Wildlife Service, Twin Cities, MN.
- U.S. Fish and Wildlife Service (USFWS). 1994. *Guidelines for managing recreational activities in Piping Plover breeding habitat on the U.S. Atlantic Coast to avoid take under Section 9 of the Endangered Species Act*. Report. U.S. Fish and Wildlife Service Northeast Region, Hadley, MA.
- U.S. Fish and Wildlife Service (USFWS). 1996. *Piping Plover (Charadrius melodus) Atlantic Coast population revised recovery plan*. Report. U.S. Fish and Wildlife Service, Hadley, VI.

- Warren, C., S. Becken, and A. Coghlan. 2016. "Using persuasive communication to co-create behavioural change—engaging with guests to save resources at tourist accommodation facilities." *Journal of Sustainable Tourism (online)* 1-20. <http://dx.doi.org/10.1080/09669582.2016.1247849>
- Weber, B.A., J. Geigle, and C. Barkdull. 2014. "Rural North Dakota's oil boom and its impact on social services." *Social work* 59: 62-72.
- Weston, M. A., and M. A. Elgar. 2007. "Responses of incubating Hooded Plovers (*Thinornis rubricollis*) to disturbance." *Journal of Coastal Research* 23: 569-576.
- Weston, M. A., and T. Stankowich. 2013. "Dogs as agents of disturbance." In *Free-Ranging Dogs and Wildlife Conservation*, ed. M. E. Gompper, Oxford, UK: Oxford University Press.
- Williams, J.A., Jr. and H.A. Moore. 1991. "The rural-urban continuum and environmental concerns." *Great Plains Research* 1: 195-214.
- Williams, K. J., M.A. Weston, S. Henry, and G. S. Maguire. 2009. "Birds and beaches, dogs and leashes: dog owners' sense of obligation to leash dogs on beaches in Victoria, Australia." *Human Dimensions of Wildlife* 14: 89-101.
- Winter, P. L., B. J. Sagarin, K. Rhoads, D. W. Barrett, and R. B. Cialdini. 2000. "Choosing to encourage or discourage: perceived effectiveness of prescriptive versus proscriptive messages." *Environmental Management* 26: 589-594.

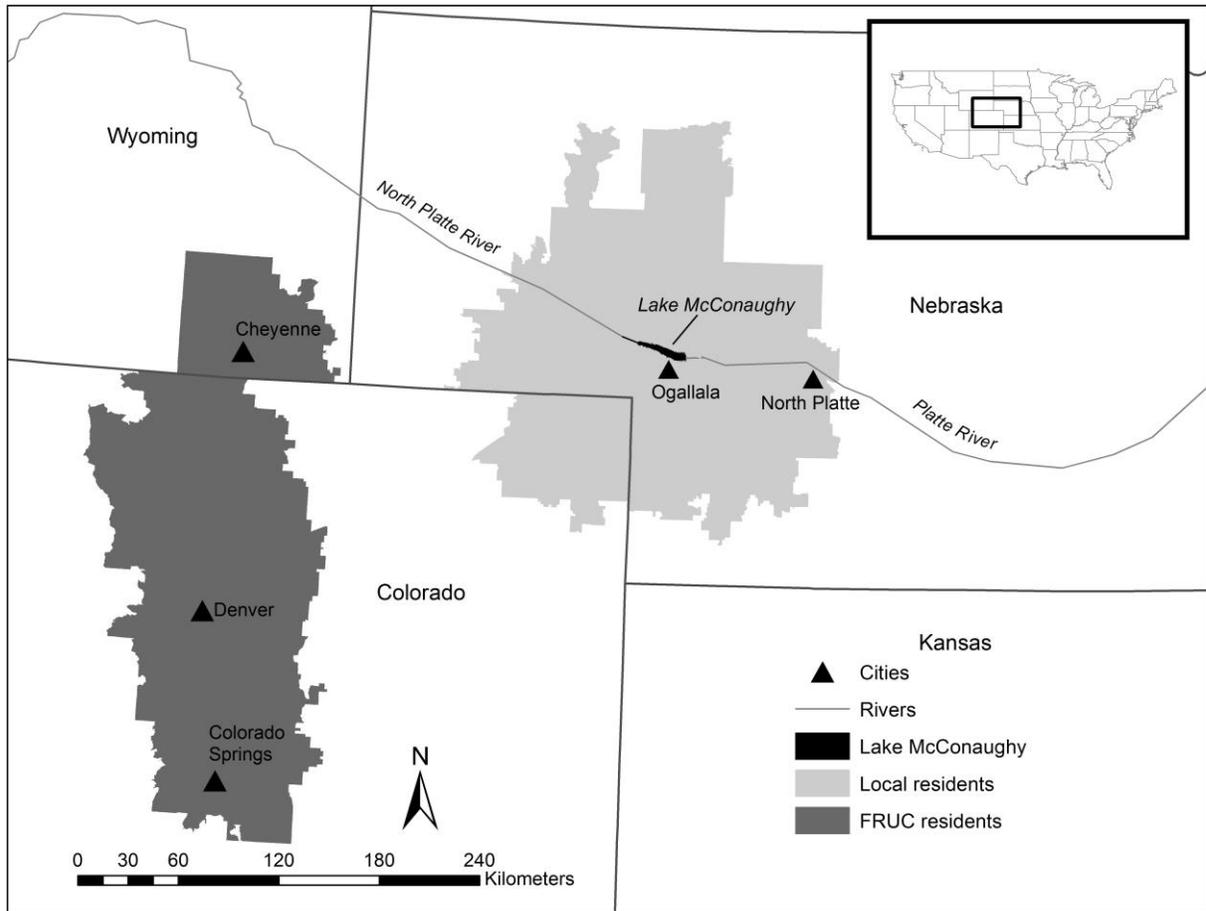


Figure 1. Location of the study area and areas of residence (From Jorgensen and Brown 2015).

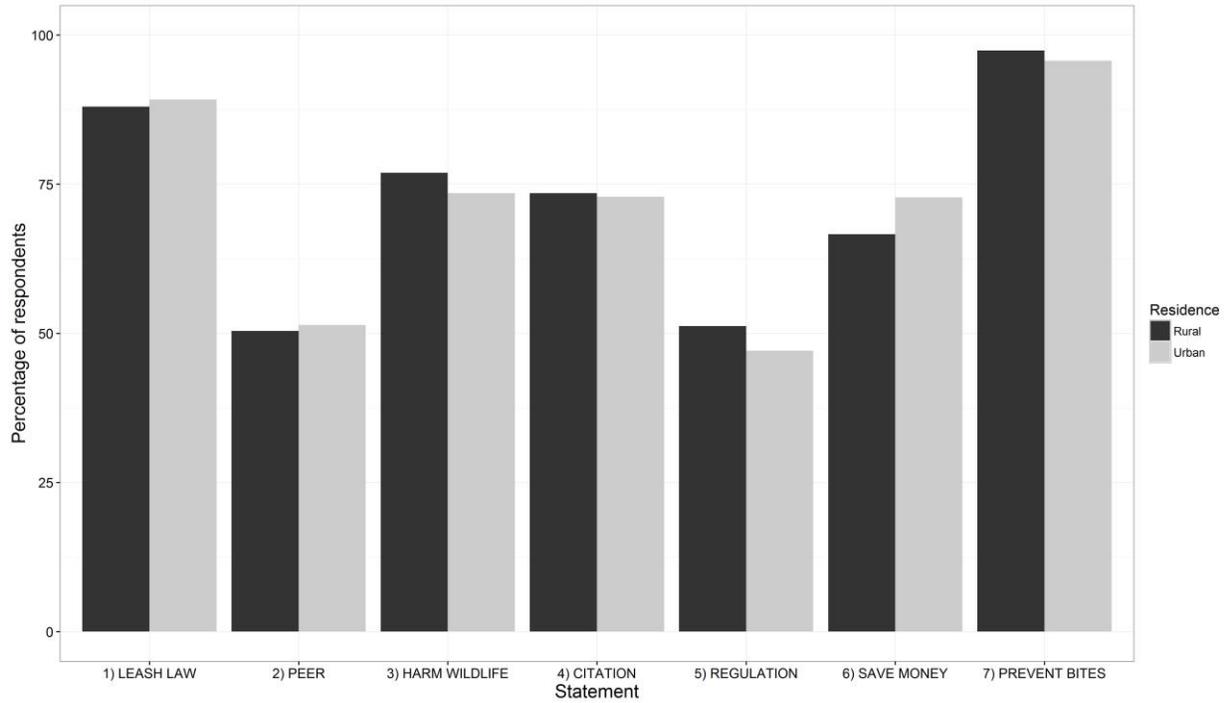


Figure 2. Percent of rural (black bars) and urban (gray bars) respondents that believed individual persuasive messages were factually accurate. There was no difference in responses between rural and urban residents (all P s > 0.32).

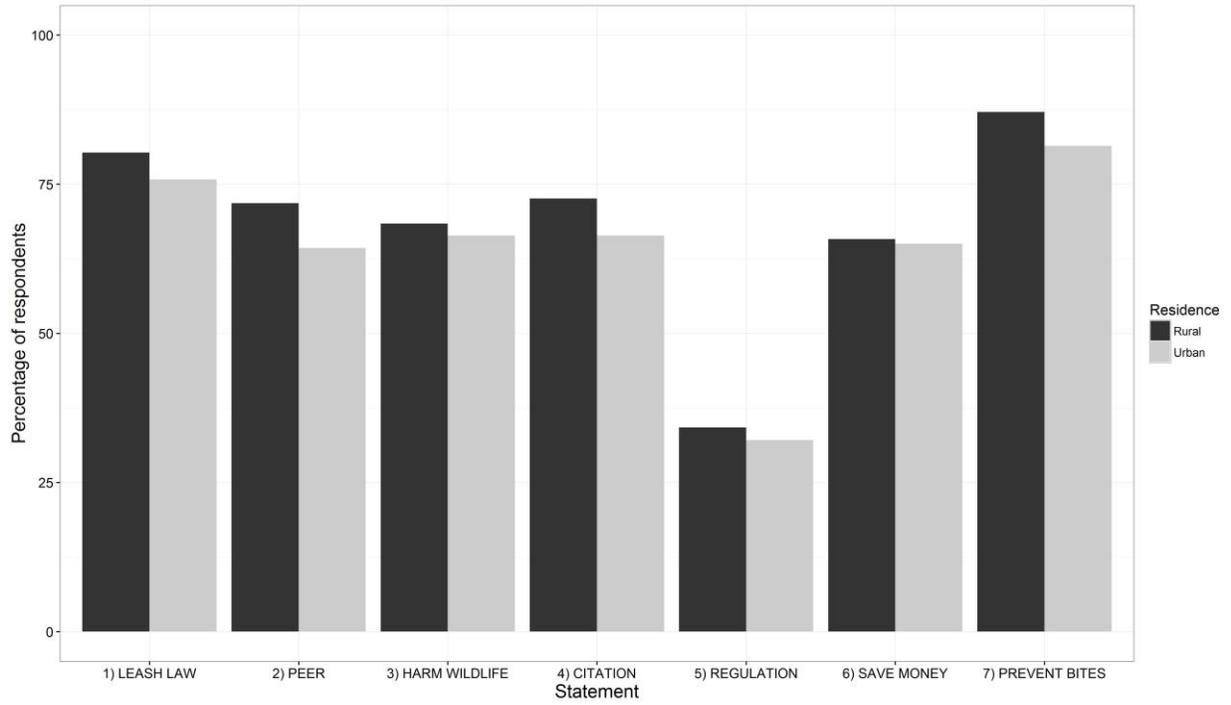


Figure 3. Percent of rural (black bars) and urban (gray bars) respondents that agreed with individual persuasive messages. There was no difference in responses between rural and urban residents (all $P_s > 0.22$).