

AN ABSTRACT OF THE THESIS OF

Carli J. Schoenleber for the degree of Master of Science in Forest Ecosystems and Society presented on August 27, 2019.

Title: Using Interpretive Signs and Theory-based Messaging to Protect the Western Snowy Plover (*Charadrius alexandrinus nivosus*)

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Although the human health and social benefits from outdoor recreation are numerous, there is mounting evidence that outdoor recreation can negatively impact wildlife. Shorebirds are known to be especially sensitive to recreation-related disturbance because they nest and forage directly on beaches that are often used for recreation. Many studies have documented negative effects of outdoor recreation on shorebirds, and some have specifically related to the federally threatened western snowy plover (WSPL) (*Charadrius alexandrinus nivosus*). The Oregon Dunes National Recreation Area (ODNRA) is a popular location for beach recreation that provides critical habitat for the WSPL. ODNRA managers struggle to keep visitors from recreating inside sensitive WSPL nesting and foraging habitat in dunes and open sand. Due to limited personnel, the ODNRA uses rope fencing and signs to communicate rules about WSPL nesting habitat.

In an effort to improve compliance and influence attitudes, this study tested signs based on two communication theories: the Focus Theory of Normative Conduct (i.e., normative) and the Extended Elaboration Likelihood Model (i.e., narrative). This thesis contains one standalone article that examines how narrative and normative messaging: (a) relates to visitor attention to

signs at the ODNRA, (b) impacts visitor attitudes related to the WSPL and their management at the ODNRA, and (c) impacts compliance with WSPL restrictions at the ODNRA.

In the summer of 2018, direct observation and questionnaires were used at a popular ODNRA beach to compare the normative and narrative signs against an existing interpretive sign on the following variables: attention capture and holding, impact on attitudes about the WSPL, and impact on beach use. A total of 440 completed questionnaires were collected with a response rate of 74%. Results showed that visitors were more likely to read the treatment signs than the existing interpretive sign, although many visitors ignored the signs altogether. The narrative sign was the most effective in encouraging visitors to stay out of WSPL nesting habitat. However, the impact of the treatment signs on attitudes was minimal compared to the existing interpretive sign. This thesis suggests changes in the design of interpretive signs at the ODNRA and recommends using a narrative format to encourage visitors to perform wildlife friendly behaviors. However, because many visitors still recreated inside WSPL nesting habitat after being exposed to signs, these signs should not be used as a primary management tool at the ODNRA. Rather, signs should be used to supplement strategies such as fencing or personal contact.

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Using Interpretive Signs and Theory-based Messaging to Protect the Western Snowy Plover
(*Charadrius alexandrinus nivosus*)

by
Carli J. Schoenleber

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Carli J. Schoenleber, Author

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CHAPTER ONE

INTRODUCTION

Despite movement of human populations to urban areas (UNDESA, 2012), Americans' interest in outdoor recreation is growing (The Outdoor Foundation, 2018). According to the Outdoor Foundation's 2018 Outdoor Participation Report, the percentage of Americans participating in outdoor recreation activities increased by approximately 7% between 2006 and 2017, with nearly half of the U.S. population participating in between 12 and 103 outdoor recreation activities per year in 2017 (The Outdoor Foundation, 2018). In national forests alone, the total number of annual visits increased by 1.8% between 2011 and 2016, representing a cumulative increase of 2.6 million visitors (U.S. Forest Service, 2016). Moreover, visitation to national wildlife refuges grew by nearly 47% from 1998 to 2015, representing an increase of approximately 15.5 million visitors, with most of this growth represented by non-consumptive activities (e.g., nature photography, wildlife watching), rather than consumptive activities (e.g., fishing, hunting) (Cordell, 2008; U.S. Fish and Wildlife Service, 2015).

Arguably, high rates of outdoor recreation bode well for human health and wellbeing; several studies have connected time spent outdoors with health benefits such as reduced blood pressure, heart rate (Park et al., 2009), and anxiety (Mackay & Neill, 2010). Recreating outdoors is also associated with conservation behaviors (Cooper, Larson, Dayer, Stedman, & Decker, 2015) and may increase pro-social behaviors such as cooperation and generosity (Zelenski, Dopko, & Capaldi, 2015; Zhang, Piff, Iyer, Koleva, & Keltner, 2014). Yet, there is mounting evidence that outdoor recreation can negatively impact natural resources in outdoor recreation areas, including soil, vegetation, water, air quality, and wildlife (Hammitt, Cole, & Monz, 2015). Furthermore, these impacts are interrelated such that one impact can result in a cascade of

subsequent impacts. For example, soil compaction from hikers can lead to inhibited plant growth, increased runoff and erosion, and changes in species composition (Hammitt et al., 2015).

Impacts to Wildlife From Outdoor Recreation Activities

For wildlife specifically, research has documented a myriad of direct and indirect impacts from outdoor recreation activities (Hammitt et al., 2015). Direct impacts typically involve interacting with wildlife by way of harassment or killing (Hammitt et al., 2015); consumptive activities clearly impact wildlife directly and can result in changes to species abundance, behavior, and population structure (Cole & Knight, 1990). Beyond consumptive activities, there is evidence that non-consumptive activities can also impact wildlife directly (Taylor & Knight, 2003). Resulting from both consumptive and non-consumptive outdoor recreation activities, indirect impacts occur via a long-term chain of events that ultimately contributes to ecosystem-wide habitat disturbance (Hammitt et al., 2015; Knight & Gutzwiller, 1995). For example, building roads and trails can increase habitat fragmentation, that may reduce wildlife species' ability to disperse (Bregman, Sekercioglu, & Tobias, 2014). Additionally, Schlacher and Thompson (2012) found human activity on beaches in Australia was associated with significant decreases in the diversity and abundance of beach invertebrates, a common food source for birds and fish.

Looking at both direct and indirect impacts from non-consumptive outdoor recreation activities, a 2016 meta-analysis revealed approximately 60% of the 274 peer-reviewed articles examined had documented at least one negative impact to wildlife populations, communities, or individuals (Larson, Reed, Merenlender, & Crooks, 2016). Moreover, several studies have shown that non-consumptive outdoor recreation activities are associated with changes in species abundance, composition, and overall diversity (Banks & Bryant, 2007; Garber & Burger, 1995;

Knight & Gutzwiller, 1995), including reductions in native wildlife diversity (Reed & Merenlender, 2008). Non-consumptive recreation has been shown to change individual animals' spatial and temporal habitat use (Borkowski, 2001; Cardoni, Favero, & Isacch, 2008; George & Crooks, 2006; Lenth, Knight, & Brennan, 2008), physiological stress levels (Arlettaz et al., 2007), and vigilance and flight responses (Taylor & Knight, 2003). Human presence in wildlife habitat can also result in wildlife becoming habituated (i.e., more docile) or more aggressive toward humans; because wildlife are often fed either intentionally or unintentionally (via litter or garbage cans) by humans, some animals may even develop a dependency on humans such that they are no longer able to forage independently (Higginbottom & Tribe, 2004).

Despite findings that outdoor recreation activities can negatively impact wildlife, it is important to note that outdoor recreation also has the potential to impact wildlife in a positive manner, particularly for some threatened and endangered species (Buckley, Morrison, & Castley, 2016). For example, money collected to pay for wildlife viewing experiences is often used for wildlife management, research, or other conservation projects. Additionally, interacting with wildlife may help foster positive attitudes toward wildlife such that visitors may be more likely to support wildlife conservation in the future (Higginbottom & Tribe, 2004).

Because outdoor recreation areas often overlap with locations of sensitive bird habitats (Steven & Castley, 2013), impacts to birds have been studied extensively in relation to non-consumptive outdoor recreation (Larson et al., 2016; Marzano & Dandy, 2012). One review of 69 peer-reviewed studies revealed that 61 studies attributed negative impacts to birds from non-consumptive outdoor recreation activities, including impacts to bird physiology, immediate behavior, abundance, and reproductive success (Steven, Pickering, & Guy Castley, 2011). Within this review, 65% of the studies documented negative impacts to birds from hiking or

walking, the most common mode of transportation among recreationists (Hammit, Cole, & Monz, 2015). More recent studies have also suggested that walking or hiking can negatively impact birds (Bötsch et al., 2018; Lethlean, Van Dongen, Kostoglou, Guay, & Weston, 2017). Ironically, birdwatching has been known to negatively impact birds (Götmark Frank, 1992; Jones & Nealson, 2005; Steven et al., 2011), likely because approaching birds is inherent to the activity (Knight & Gutzwiller, 1995) and birds are thought to perceive humans as predators (Beale, Monaghan, & Monaghan, 2012).

Managing Depreciative Behavior in Outdoor Recreation Areas

In light of studies documenting a relationship between non-consumptive outdoor recreation and negative impacts to wildlife (Knight & Gutzwiller, 1995; Steven et al., 2011), protected area managers often establish restrictions to separate recreationists and wildlife (Lafferty, Goodman, & Sandoval, 2006). However, for a variety of reasons, recreationists do not always follow restrictions; thus, managers and researchers have developed a diversity of management strategies to increase compliance (Manning, 2011). According to Manning (2011), these strategies are generally categorized as direct or indirect.

Direct strategies focus on physically limiting the freedom of recreationists (e.g., fences, barriers, permits), and indirect management strategies attempt to increase compliance by targeting the decision-making processes underlying visitor behavior and influencing visitors to behave in a certain manner (Manning, 2011). While direct strategies have shown to be effective in changing visitor behavior (Burger & Niles, 2013; Vaske et al., 1992), managers may deem them infeasible due to the time, money, and staffing required for implementation and enforcement throughout an entire recreation area (Manning, 2011). Additionally, a principal argument against direct management practices is that limiting visitor freedom runs contrary to a

fundamental purpose of outdoor recreation areas being spaces for the public to be unconfined (Manning, 2011; Marion & Reed, 2007). Given direct management may be infeasible or unpopular to implement throughout many outdoor recreation areas, managers often rely on interpretive signs, a low-cost, indirect management strategy, to communicate important information to visitors (Manning, 2011). Though many interpretive signs have proven ineffective (Kidd et al., 2015), some studies have found well-designed interpretive signs create positive attitudes toward restrictions and increase the likelihood of compliant behavior (Hockett, Marion, & Leung, 2017). To maximize the potential for signs to impact visitor attitudes and behavior, many researchers have emphasized the importance of building messages using social psychology and communication theories (Jorgensen & Bomberger Brown, 2015; Marion & Reid, 2007; Widner & Roggenbuck, 2000).

Theory-Based Messaging to Reduce Depreciative Behavior

The Elaboration Likelihood Model (ELM) of persuasion is one conceptual model that has been utilized in outdoor recreation areas to encourage pro-environmental behaviors (Ham et al., 2009, 2008; MacDonald, Milfont, & Gavin, 2016; Petty, McMichael, & Brannon, 1992). The ELM posits that the more a person thinks deeply about a strong message (i.e., elaborates on it), the more likely the message will result in attitude change. This model is often used to influence attitudes toward a behavior that is encouraged or discouraged. Additionally, the ELM identifies certain factors that, when met, encourage elaboration on the message, including motivation to process, ability to process, and type of cognitive responses (Petty & Cacioppo, 2012). More recently, the Extended Elaboration Likelihood Model (E-ELM) has been proposed to incorporate the use of narrative, or story-telling, into the ELM. The E-ELM posits that when narrative is used in a persuasive message, the message recipient is more likely to elaborate on the message and

less likely to resist arguments in the message, which are two factors essential to achieving attitude and behavior change (Moyer-Gusé, 2008). Although several studies have successfully utilized the ELM to create interpretive messages on signs (Brown, Ham, & Hughes, 2010; Ham et al., 2008; Hockett & Hall, 2007), there is a paucity of literature utilizing narrative-based signage (i.e., E-ELM) in an outdoor recreation context (Hall, Ham, & Lackey, 2010).

Social norms messaging is another tactic used for influencing behavior (Winter, 2006), but most studies utilizing social norms in an environmental context have focused on littering, recycling, and energy use (Cialdini et al., 2006; Cialdini, Reno, & Kallgren, 1990; Schultz, 1999; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Cialdini et al. (1990) developed the Focus Theory of Normative Conduct, which theorized that people follow social norms insofar as the norm is made salient, or noticeable (Cialdini et al., 1990). Their study also distinguished between injunctive norms (i.e., what society deems you should do) and descriptive norms (i.e., what people actually do) (Cialdini et al., 1990). Since this landmark study, subsequent studies on social norms have made the following significant findings: (a) injunctive norms may sometimes guide behavior despite a contradicting descriptive norm (Reno, Cialdini, & Kallgren, 1993), (b) the impact of injunctive norms may extend beyond the specific situation in which they are made salient (Reno et al., 1993), (c) descriptive norms and injunctive norms should be in alignment in a message (Cialdini, 2003; Smith et al., 2012), and (d) reference groups used to portray a descriptive norm should be as similar to the target audience as possible (Goldstein, Cialdini, & Griskevicius, 2008). Despite these significant findings and applications related to pro-environmental behavior, few studies have tested the efficacy of social norms messaging in an outdoor recreation setting, thus presenting an opportunity to contribute to this understudied area in the outdoor recreation literature (Winter, 2006).

Thesis Purpose and Organization

There is little question of the importance of managing for sensitive wildlife habitat, especially when the survival of a federally listed species is dependent on effective management. Yet, because many outdoor recreation area managers are limited in terms of adequate funding and staffing to manage for depreciative behavior that negatively impacts wildlife, using interpretive signs to communicate with visitors may be the best option for managers who must carefully weigh the effectiveness of the strategy with its feasibility in terms of cost and maintenance. Recognizing that managers often rely on well-designed interpretive signs to manage for depreciative behavior, this thesis explores the extent that narrative and social norms messaging on signs impacts visitor attention, attitudes, and behavior related to the threatened western snowy plover (WSPL) at the Oregon Dunes National Recreation Area (ODNRA). The ODNRA is an appropriate location for this research because its beaches are managed for both recreation and WSPL nesting habitat. Moreover, because peak use levels line up with the WSPL breeding season (i.e., spring and summer months) at the ODNRA, it is especially critical that signs effectively minimize disturbance during this time. The purposes of this thesis are to: (a) examine how narrative and social norms messages relate to attention capture and attention holding of signs at the ODNRA, (b) explore how signs using narrative and social norms messages impact visitor attitudes related to the WSPL at the ODNRA, and (c) assess whether narrative or social norms messages on signs can reduce depreciative behavior such that impacts to the WSPL are mitigated at the ODNRA. A quasi-experimental design was used to test two treatment signs against a control sign at the ODNRA. To evaluate the effectiveness of the signs, this research utilized surveys and two types of direct observation.

This thesis will be one of the first studies to utilize the E-ELM conceptual framework in an outdoor recreation area, while also contributing to applications of social norms messaging research in outdoor recreation areas. Hence, insights gained from this thesis will move the outdoor recreation signage literature forward, painting a clearer picture of how signs can be used to effectively communicate important information to visitors such that depreciative behavior is minimized and natural resources in the outdoor recreation area are minimally disturbed. Additionally, since this study occurred in an outdoor recreation area that contains sensitive wildlife habitat, managers of the ODNRA can use these findings to help decide the extent that signs can be relied on to protect the WSPL or if direct management strategies should also be used in conjunction with signs.

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CHAPTER TWO

ARE SIGNS ENOUGH? USING NORMATIVE AND NARRATIVE MESSAGING TO PROTECT THE WESTERN SNOWY PLOVER (*CHARADRIUS ALEXANDRINUS NIVOSUS*) IN COASTAL OREGON

Introduction

Many studies have observed an association between outdoor recreation and changes in wildlife physiology, behavior, reproduction, and population characteristics (Hammitt, Cole, & Monz, 2015). Shorebirds -- birds that utilize shoreline habitat (e.g., beaches, mudflats) along the ocean, rivers, or in wetlands -- are especially susceptible to human disturbance as they depend on shoreline habitat that is often also used by recreationists (van Polanen Petel & Bunce, 2012). Many studies have documented impacts from outdoor recreation to shorebird species, including increased energy expenditure (Goss-Custard, Triplet, Sueur, & West, 2006), loss of foraging time (Burger & Gochfeld, 1991; Burger, Jeitner, Clark, & Niles, 2004; Fitzpatrick & Bouchez, 1998), and displacement into limited areas of suitable habitat where there is less human activity (Lafferty, Goodman, & Sandoval, 2006; Lafferty, Rodriguez, & Chapman, 2013; McCrary & Pierson, 2000). About the size of a sparrow, the western snowy plover (WSPL) (*Charadrius alexandrinus nivosus*) is a small species of shorebird that has historically lived on the United States Pacific coast (U.S. Fish and Wildlife Service, 2007). In Oregon, one place the WSPL can be found is in the Oregon Dunes National Recreation Area (ODNRA), a popular recreation destination along the Oregon coast.

Western Snowy Plover Regulatory Status and Behavior

Historically, the WSPL was prevalent along the entire Pacific coast, with its range extending south into Baja California, Mexico (U.S. Fish and Wildlife Service, 2007). Although the species is still present throughout its historic range, the number of active breeding sites has

decreased significantly (U.S. Fish and Wildlife Service, 2007). In Oregon, WSPL breeding is mainly limited to nine sites along the Pacific coast, representing a 65% decline in historical nesting sites (U.S. Fish and Wildlife Service, 2007, 2019). Due to dwindling populations and increasing habitat loss, the WSPL was listed as a threatened species under the U.S. Endangered Species Act in 1993 (Oregon Revised Statutes, 2017; U.S. Fish and Wildlife Service, 1993; Oregon Department of Fish and Wildlife, 2018). At the time of federal listing in 1993, there were only 33 WSPLs reported to be living in Oregon (Lauten, Castelein, Bailey, Lewis, & Gaines, 2017). In 1994, the Oregon Fish and Wildlife Commission outlined management actions designed to protect WSPL habitat (ICF International, 2010) and 2017 estimates indicate there were a minimum of 468 WSPLs present on the Oregon coast (Lauten et al., 2017).

Along the Oregon coast, WSPLs begin nesting in mid-March and continue to initiate nests through early July (Meslow, 1984). WSPLs typically nest on the dry sand above the high tide line on open, sandy beaches (Page, Stenzel, Warriner, Warriner, & Paton, 2009). After the adult WSPLs choose a nesting site, consisting of a shallow depression in the sand, they lay a clutch of two to six eggs that are incubated for approximately 27 days (Page et al., 2009). WSPL chicks hatch between mid-April and mid-August, with most chicks hatching in June and July (ICF International, 2010). Soon after hatching, females will often lay a second or third clutch of eggs while the male takes most of the chick-rearing responsibility (Page et al., 2009). WSPLs primarily forage on invertebrates along the beach's "wrack-line," where ocean debris is left following the receding of high tide (Page et al., 2009). For the first seven days after hatching, chicks do not have full mobility and are particularly vulnerable to hypothermia and predation (ICF International, 2010). From the time chicks hatch, they fledge in approximately 31 days, with most fledging occurring in Oregon from mid-July through August (Warriner, Warriner,

Page, & Stenzel, 1986), a time period that also coincides with peak recreation use on Oregon's beaches.

Beach Recreation Impacts to WSPLs

Beach recreation can pose a direct threat to WSPLs and their nests because WSPLs often go unnoticed due to their small size and ability to camouflage into the sand. It is not uncommon for nests and chicks to be crushed by people walking or running down the beach (Warriner et al., 1986). Off-leash dogs and off-highway vehicles (OHVs) can also pose a direct threat to WSPLs and their nests, especially because WSPLs are known to use tire tracks for nesting, leaving nests and chicks vulnerable to crushing when OHVs return (ICF International, 2010).

Beach activities can also pose an indirect threat to WSPL reproductive success. When humans get too close to a WSPL nest, adult WSPLs may flush the nest, leaving incubating eggs or newly hatched chicks unprotected (Ruhlen, Abbott, Stenzel, and Page, 2003; Page et al., 2009). Excessive flushing can cause eggs to become too hot, too cold, or take longer to hatch, or eggs may become buried in the sand, blown out of the nest, trampled, or eaten by predators (Page, Warriner, Warriner, Halbresen, and Peaslee as cited in ICF international, 2010; Warriner et al., 1986). In addition to flushing, WSPLs also protect eggs and chicks by initiating a distraction display, such as feigning an injured wing. Although this technique can be effective, sometimes adults and chicks become permanently separated in the process, often resulting in chick mortality. Repeated indirect impacts over time can ultimately impact survival, as WSPLs and their chicks spend less energy feeding and roosting, resulting in loss of fat reserves (Brown, Hickey, Harrington, & Gill, 2001; Lafferty, 2001). Beach recreationists may also limit access to suitable nesting habitats and feeding areas WSPLs otherwise might utilize (Vaske, Deblinger, & Donnelly, 1992).

To effectively prevent both direct and indirect impacts to the WSPL from outdoor recreation, it is necessary to spatially separate human activities from important nesting and foraging WSPL habitat on beaches (Lafferty et al., 2006). Given that WSPLs commonly nest on the dry sand areas of the beach and forage near the beach's wrack line (Page et al., 2009), encouraging people to stay on the wet sand of the beach (i.e., below the high tide line) can be an effective management strategy to prevent negative impacts to the WSPL (Siuslaw National Forest, 2018). Yet, it can be difficult to communicate that only a small portion of the beach is allowed for recreation, especially because the tide changes the wet-dry sand boundary throughout the day (U.S. Forest Service, 2017). Thus, without adequate communication techniques to relay this information, it is likely that people will inadvertently recreate in dry-sand WSPL habitat and disturb nesting or foraging WSPLs.

Depreciative Behavior and Management Strategies

Outdoor recreation managers seek to reduce depreciative visitor behaviors that result in negative impacts to the environment (Manning, 2011). According to Namba and Dustin (1992), depreciative behaviors are often committed unintentionally when a person is unaware of the consequences of a damaging action. At the ODNRA, managers are trying to reduce the depreciative behavior of visitors walking on the beach's dry sand, which negatively impacts WSPLs (Siuslaw National Forest, 2018). To prevent depreciative behaviors in outdoor recreation areas, managers have developed a wide range of direct and indirect strategies (Manning, 2011).

Direct strategies aim to limit depreciative behaviors by restricting recreationists' freedom of movement through laws, use limits, or creating physical barriers, such as fences; however, it is important to note that some direct management strategies, such as fences, require enforcement by managers in order for the strategy to truly be categorized as direct (Manning, 2011). Although

direct strategies have shown to be effective (Hockett et al., 2017; Lafferty et al., 2006), they suffer from two disadvantages: (a) it is not always feasible or visibly pleasing to physically barricade all sensitive areas in an outdoor recreation area, and (b) laws can be difficult and expensive to enforce (Manning, 2011), especially when they are seasonal in nature. Indirect strategies, on the other hand, target the decision-making process underlying the depreciative behavior. When people are largely unaware they are engaging in depreciative behavior, indirect strategies often involve educating visitors on the consequences of their behavior and how to properly comply with rules and regulations (Manning, 2011). Personal contact is often cited as the most effective indirect strategy in minimizing depreciative behavior (Hockett et al., 2017; Kernan & Drogin, 1995; Marion & Reid, 2007). Successful personal contact interventions include having uniformed officials present in an outdoor recreation area or having uniformed officials deliver a low-impact message to visitors (Hockett et al., 2017; Kernan & Drogin, 1995; Kidd et al., 2015; Swearingen & Johnson, 1995).

However, personal contact is not always a practical option, especially considering that signs, another form of indirect management, are relatively inexpensive, durable, and easy to distribute across a large recreation area. Yet, many studies have shown signs are often ignored by visitors (Hockett et al., 2017; Hughes & Morrison-Saunders, 2002; Kidd et al., 2015; McCool & Cole, 2000; Park, Manning, Marion, Lawson, & Jacobi, 2008). To improve the impact of signs, some scholars have emphasized that messages on signs should be grounded in social psychology and communication theories (Marion & Reid, 2007; Widner & Roggenbuck, 2000). As Jorgensen and Bomberger Brown (2015) asserted, “management plans should consider a more sophisticated, human-dimensions approach to communication and education that is based on

conceptual frameworks regarding how humans receive and process information and how information influences attitudes, behaviors, and social norms” (p. 377).

Social Norms Messaging

Social norms messaging is a popular tactic used for decreasing depreciative behaviors in outdoor recreation areas (Winter, 2006; Winter & Cialdini, 1998). However, much of the research studying social norms in the context of pro-environmental behavior has focused on recycling, littering, and energy conservation (Kallgren, Reno, & Cialdini, 2000; Schultz, 1999; Smith et al., 2012).

Cialdini, Reno, and Kallgren (1990, 1991) introduced the Focus Theory of Normative Conduct, which posited that adherence to a social norm is dependent on whether or not that norm is made salient, or noticeable, to a message recipient. Their study also emphasized the importance of expanding the concept of social norm to distinguish between injunctive and descriptive norms. Injunctive norms communicate what society deems morally acceptable (e.g., you should drive the speed limit), whereas descriptive norms communicate what most people tend to do in regard to a certain behavior (e.g., most people drive 5 mph over the speed limit) (Cialdini et al., 1990). Both types of norms can have significant impacts on behavior when they are salient to people at the place and time where behavior might occur. Recent guidance emphasizes the importance of aligning injunctive and descriptive norms when both are present in a message (Cialdini, 2003; Smith et al., 2012). In contrast to injunctive and descriptive norms, a *situational norm* is posited to influence behavior automatically, without first being made salient or focal. Situational norms are thought to occur when there is a strong association between a specific behavior and a particular environment (e.g., being quiet in a library) (Aarts & Dijksterhuis, 2003).

Reference groups and retrieval cues are also important to consider when crafting normative messages. At least one study has suggested that making the reference group (i.e., the category of people referred to in the message) specific to the location where the message is being communicated may be more effective than reference groups assumed to be personally significant to the recipient (e.g., gender or nationality) (Goldstein, Cialdini, & Griskevicius, 2008).

Additionally, there is evidence that retrieval cues can make normative messages more mentally accessible over time (Goldstein & Cialdini, 2009). A retrieval cue effectively helps someone remember a message and is dependent on establishing similarity between the message and some visible reminder in the environment (Bator & Cialdini, 2000).

Messaging to Promote Attitude and Behavior Change

Beyond social norms, targeting visitor attitudes and behaviors through education is another tactic that outdoor recreation managers use for decreasing depreciative behavior (Marion & Reid, 2007). According to Ajzen (2012), attitudes are formed based on behavioral beliefs one holds about the attitude object and one's evaluation of those beliefs. The behavioral beliefs are those outcomes a person believes will arise from the behavior, and the evaluation is whether one considers those outcomes to be positive or negative. Scholars have aimed to understand the formation of pro-environmental attitudes because they believe such attitudes will lead to pro-environmental behavior (Gifford & Sussman, 2012; Heberlein, 1981). In the context of an outdoor recreation setting, actively avoiding depreciative behavior can be understood as a pro-environmental behavior, because avoiding depreciative behaviors positively impact the recreation area's environment (Bradford & McIntyre, 2007). Although many studies have observed a link between pro-environmental attitudes and behavior (Heberlein & Black, 1981; Kuhlemeier, Van Den Bergh, & Lagerweij, 1999; Poortinga, Steg, & Vlek, 2004; Tarrant &

Cordell, 1997), other studies have noted that general environmental concern is unlikely to influence specific pro-environmental behaviors (Balderjahn, 1988; Tanner & Kast, 2003). Rather, it is more effective to target specific pro-environmental attitudes (e.g., attitude that plastic water bottles are harmful) to predict specific pro-environmental behaviors (e.g., avoiding plastic water bottles) (Bamberg, 2003; Mobley, Vagias, & DeWard, 2010).

Elaboration Likelihood Model

In light of the documented link between specific attitudes and behavioral intentions and, in some cases, actual behaviors, there exists a large body of literature on how to influence attitudes to shape subsequent behaviors, including research in the environmental arena. The Elaboration Likelihood Model (ELM) of persuasion is a communication framework commonly applied in interpretation and outdoor recreation settings to educate or promote certain attitudes and behaviors (Ham et al., 2009, 2008; MacDonald, Milfont, & Gavin, 2016; Miller, Freimund, & Powell, 2018; Miller, Freimund, Metcalf, & Nickerson, 2018; Petty, McMichael, & Brannon, 1992; Vezeau, Powell, Stern, Moore, & Wright, 2015). According to the ELM, a persuasive message can achieve attitude change via two distinct routes of information processing, central and peripheral (Petty & Cacioppo, 2012). The central route involves the person carefully thinking about, processing, and elaborating on the message; *elaboration* is the extent that a person thinks deeply about the content and arguments presented in the message. The more the person elaborates on the message, the more the message is processed centrally, and the more cognitive effort that is required. In contrast, the peripheral route involves low cognitive effort, with attitude change dependent on cues such as perceived credibility of the message source and current mood of the message recipient (Petty & Cacioppo, 2012). Design factors such as color (e.g., red signals danger) or the use of a credible source, such as Smoky Bear, are peripheral cues

that may encourage visitors to accept the message, even if they do not process the content of the message deeply. Although both routes to persuasion can result in attitude change, long-term attitude change is more likely when the person processes the message centrally, requiring the person to think critically about the message arguments in the context of their pre-existing beliefs and feelings about the issue (Petty & Cacioppo, 2012).

Attitude change through the central route of persuasion is dependent on several factors including a person's *motivation to process* the message, *ability to process* the message, and *type of cognitive processing*. Motivation to process relates to a person's interest in the message and its perceived personal relevance; several studies have shown that as personal relevance of the message increases, so too does a person's elaboration on it (Petty & Cacioppo, 1979; Petty et al., 1992). The importance of personal relevancy for *attention holding*, a concept similar to central processing, is also reflected in the environmental interpretation literature (Moscardo, Ballantyne, & Karen, 2007). Simply changing the pronouns used in a message from the third to second person (i.e., "one," "he," or "she" to "you") can increase personal relevance (Burnkrant & Unnava, 1989).

The ELM also takes into account recipients' ability to process the message. According to Petty and Cacioppo (2012), this mainly boils down to whether a person can concentrate long enough to elaborate on the message. High levels of distraction (Petty, Wells, & Brock, 1976) and lengthy messages are two factors that may impede a person's ability to concentrate on the message (Petty et al., 1992). Again, these ideas are also reflected in the environmental interpretation literature that emphasizes the importance of designing text so it is easy to read and keeping vocabulary simple (Moscardo et al., 2007).

Beyond motivation and ability to process a message, the impact of a message on attitudes is a function of cognitive processing, specifically the number and type of thoughts one has during elaboration. Both the strength and content of the arguments presented can impact whether one has positive thoughts in agreement with a message or negative thoughts contradicting a message. Generally, a strong argument is more likely to result in positive attitude change than a weak argument (Petty & Wegener, 1998). Furthermore, elaboration of a weak argument can be counterproductive and result in negative attitude change (Petty & Cacioppo, 2012).

It should be noted that even if a persuasive message results in the development of a pro-environmental attitude, regardless of whether it is processed centrally or peripherally, there is no guarantee the attitude change will result in a recipient performing the targeted behavior (Petty et al., 1992). Additionally, *resistance* from message recipients can entirely thwart a persuasive attempt. For example, people may avoid or argue against messages that run contrary to their existing beliefs (Festinger, 1957; Knobloch-Westerwick & Meng, 2009).

Narrative, the Extended Elaboration Likelihood Model, and Empathy

A strategy that has shown promise in decreasing resistance to persuasion is the use of narrative, or story-telling, in messaging. According to Dahlstrom (2012), a narrative can be characterized as “communication involving a temporal sequence of events influenced by the actions of specific characters” (p. 593). Communication through narrative is thought to be processed differently in the brain, resulting in improved comprehension, with narrative text being read and recalled at twice the rate of evidence-based text (Graesser, Hauff-smith, Cohen, & Pyles, 1980; Haberlandt & Graesser, 1985). Narratives may also create more interest in a topic (Green, 2006; Green & Brock, 2000) and increase feelings of self-efficacy (Oatley, 1999; Slater & Rouner, 2002). The Extended Elaboration Likelihood Model (E-ELM) incorporates the power

of narratives into the traditional ELM (Slater & Rouner, 2002). Essentially, the E-ELM argues that use of narratives makes message recipients less likely to counterargue with persuasive messages, ultimately increasing the likelihood the message will result in positive attitude change (Slater & Rouner, 2002). According to E-ELM, two strategies one might use in a narrative to decrease counterarguing are increasing transportation and character identification.

Transportation is an immersive state “where all mental systems and capacities become focused on events occurring in the narrative” (Green & Brock, 2000, p. 701). There is evidence that transportation results in less counterarguing and increased acceptance of a persuasive message, because people are more focused on enjoying the story than on finding reasons to challenge its structure or events (Deighton, Romer, & McQueen, 1989; Green & Brock, 2000). There is also evidence to suggest that these effects can be achieved through the process of *identification* (Slater & Rouner, 2002). According to Cohen (2001), identification “is a mechanism through which audience members experience reception and interpretation of the text from the inside, as if the events were happening to them” (p. 1). Given that identification involves feeling *as* the character feels, it may help increase personal relevance of (Campbell & Babrow, 2004) and elaboration on a message (Cohen, 2001; Edwards & La Ferle, 2003; Petty & Cacioppo, 1984; Shen, 2010), or encourage people to consider viewpoints they otherwise may have avoided (Moyer-Gusé, 2008).

Similarly, evoking *empathy* through messaging has also been shown to increase elaboration on a message (Campbell & Babrow, 2004). According to Daniel, Batson, and Ahmed (2009), empathy can involve imagining how another thinks or feels in a situation (i.e., cognitive empathy) or feeling *as* or *for* another person because of their situation (i.e., affective empathy).

Based on this definition, it is not surprising that identification is deemed a primary driver in reaping the persuasive rewards of empathetic messaging (Campbell & Babrow, 2004). In recognizing that identification plays a key role in both narrative and empathy-based messaging, literature examining the relationship between empathy and pro-environmental attitudes and behaviors is relevant to the E-ELM discussion. Grounded in Batson's Model of Altruistic and Prosocial Behavior (1991), some studies have found pro-environmental attitudes (Schultz, 2000; Sevillano, Aragonés, & Schultz, 2007) and behaviors (Berenguer, 2007; Paul & Bauer, 2013; Pfattheicher, Sassenrath, & Schindler, 2016; Swim & Bloodhart, 2014) can be increased by simply putting subjects in a state of empathy or by having subjects take the perspective of an animal or human negatively impacted by an environmental issue.

Despite the potential benefits of utilizing narrative to deliver a persuasive message, a downfall is that it may require a greater level of concentration because a narrative message would likely require more text and take longer to read than a typical message one might encounter in an outdoor recreation area (Petty et al., 1992). Yet, in outdoor recreation settings, at least one study has illustrated that narrative messages are likely to be read more often and at greater length than other types of messages, such as those appealing to humor or empathy (Hall, Ham, & Lackey, 2010). However, more research is warranted on utilizing narrative in signs to deter depreciative behaviors in outdoor recreation areas.

Attention Capture and Holding for Interpretive Signs

Regardless of whether information on a sign is grounded in theory, it is still likely to be ignored if the sign's design fails to capture and hold visitor attention. Serrell (1997) argued that for a visitor to comprehend a sign's message, the visitor's attention must first be attracted. In general, the environmental interpretation literature has shown that people tend to pay attention to

messages that are surprising, unexpected, or extreme. Specifically, these types of messages may contain bright colors, graphics and illustrations, or provocative titles that make the message more personally relevant to the visitor (Moscardo et al., 2007; Moscardo, Woods, & Saltzer, 2004). Once a visitor's attention has been attracted, it must be held long enough for the entire message to be processed. From the field of environmental interpretation, this can be understood as a cost-benefit tradeoff where a visitor only maintains attention if the effort required is less than the reward they get from reading the message (Moscardo et al., 2007). Ways for increasing the reward to visitors include making the message personally relevant, using a conversational writing style, and encouraging action. To reduce cognitive effort, a sign should be formatted so it is easy to read (Moscardo et al., 2007). Considerations related to capturing and holding attention are especially important in the setting of an outdoor recreation area because recreationists are known to engage in "scripted" (i.e., automatic) behaviors without much thought (Werner, Rhodes, & Partain, 1998). Werner et al. (1998) suggested that in cases where scripted behavior (e.g., walking anywhere on the beach) is not in alignment with a location's rules (e.g., dry sand beach restriction), it is especially important that a sign interrupts scripted behavior by being especially visible, novel, and explicit in its message.

Research Questions

This study tested the efficacy of two new interpretive signs against an existing interpretive sign at a popular beach in the ODNRA. The first new sign's message was based on the Focus Theory of Normative Conduct and the second sign's message was based on the E-ELM; each sign was designed with the overall intention of keeping visitors away from key WSPL habitat (i.e., dry sand). Given direct management strategies can be expensive and difficult to enforce, managers often utilize indirect management strategies, such as signs, to decrease

depreciative behavior among visitors. Thus, with managers' reliance on signs in mind, it is imperative to explore the extent to which well-designed, theory-based, interpretive signs can influence visitor attitudes and behavior.

To this end, few studies have tested the power of narratives in persuasive messaging in an outdoor recreation setting (Hall et al., 2010). Building on Hall et al. (2010), this study not only examines the relationship between narratives and attention to messages but also explores how narrative messaging relates to pro-environmental attitudes and behaviors. Furthermore, there have only been a few studies examining the impact of social norms messaging in outdoor recreation areas (Cialdini et al., 2006; Winter, 2006). Thus, it is worth further exploring how social norms impact behavior in the unique setting of an outdoor recreation area. Finally, it is especially crucial to bring the literature forward on this topic because of the potential to reduce negative impacts to sensitive wildlife species such as the federally threatened WSPL. With the results of this study, managers at the ODNRA will be more informed on how to amend existing signs or create new signs related to the WSPL management.

Recognizing that managers rely on signs to minimize depreciative behavior in outdoor recreation areas, the overall aim of this study is to explore the extent to which well-designed interpretive signs, a relatively cost-effective management strategy, can impact visitor attention, attitudes, and behavior. More specifically, the first aim of this study is to contribute to limited research on the impact of narrative messaging and social norms messaging on attention holding. By analyzing the differences in each sign's ability to hold attention, the degree of elaboration, or central processing, on the sign's message can be inferred. The second purpose of this study is to contribute to limited research on how narrative messaging or social norms messaging can be utilized to impact visitor attitudes in outdoor recreation areas. The third purpose of this study is

to contribute to limited literature on how narrative messaging and social norms messaging impact depreciative behavior in an outdoor recreation area with sensitive wildlife species at risk.

To address these study objectives, the three research questions for this article are as follows:

- (a) To what extent do interpretive signs utilizing narrative messaging or social norms messaging hold visitors' attention?
- (b) How does narrative messaging or social norms messaging on signs relate to attitudes regarding the WSPL and its management?
- (c) How does narrative messaging or social norms messaging on signs relate to frequency of depreciative behavior?

Methods

Study Site

The ODNRA is located along the Pacific Coast of central Oregon between the cities of Florence and North Bend (Figure 1). The ODNRA is approximately 40 miles in length from north to south, with an average width of 1.5 miles; it encompasses approximately 31,500 acres, with 28,900 acres managed by the U.S. Forest Service (U.S. Forest Service, 1994).

The ODNRA was first established in 1972 when Congress set it aside as a distinct part of the Siuslaw National Forest. This is a unique and dynamic landscape, containing sand dunes, coniferous forest, freshwater lakes, and streams. With its varied characteristics comes a multitude of recreation opportunities for visitors, along with habitat for many plant and animal species, including critical habitat for the WSPL. Recreation opportunities include hiking, camping, OHV riding, and horseback riding. The most recent use estimates in 2016 suggested that approximately 440,000 cars enter the ODNRA annually (U.S. Forest Service, 2016).

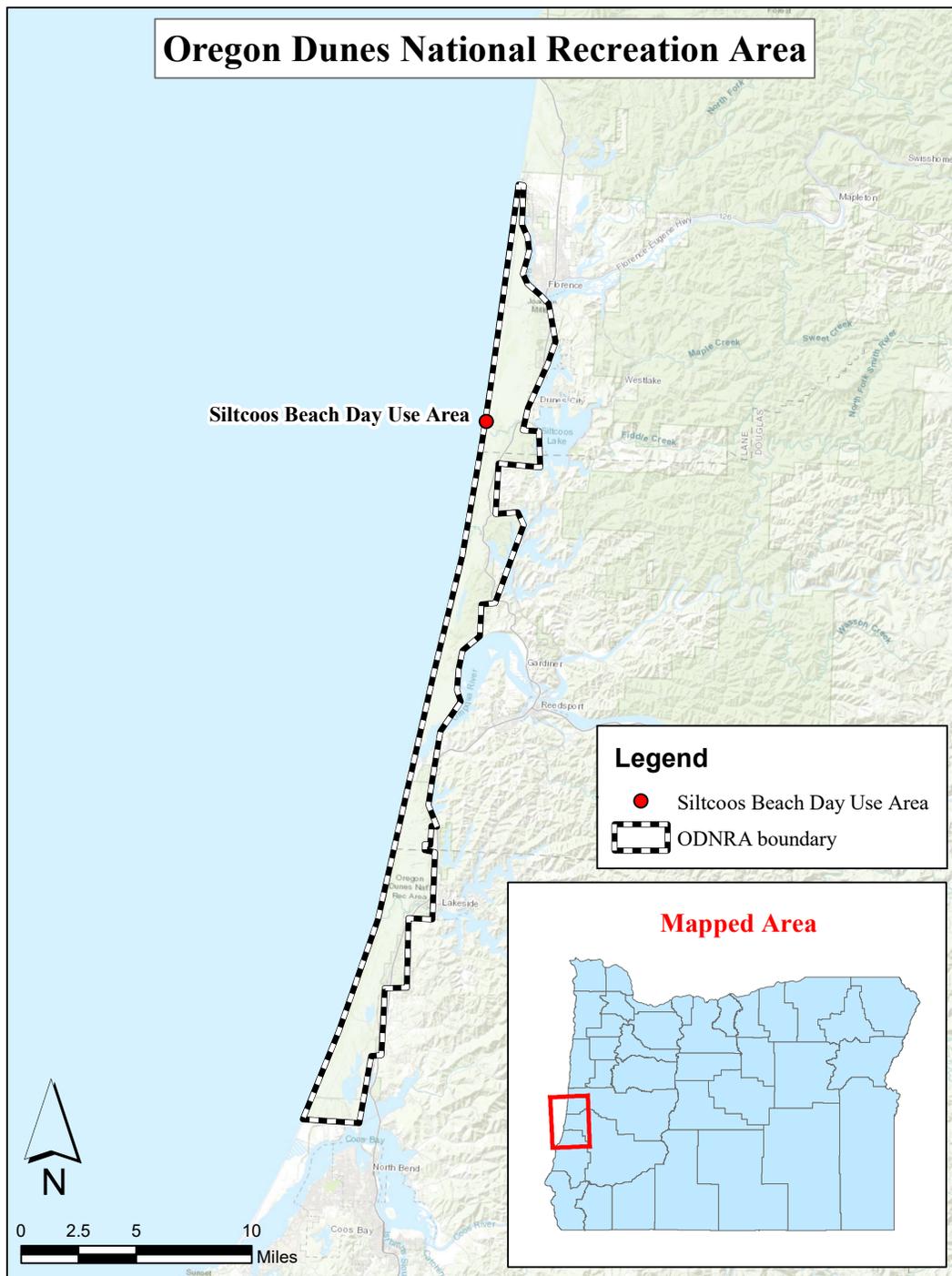


Figure 1. Oregon Dunes National Recreation Area map. Basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

WSPL Management in Oregon and the ODNRA

The 2010 Habitat Conservation Plan for the WSPL outlined conservation measures to be implemented and enforced in five Snowy Plover Management Areas (SPMAs) owned by the Oregon Parks and Recreation Department (OPRD) and 11 Recreation Management Areas (RMAs) that are privately owned, county owned, or adjacent to federally owned land. One federally adjacent RMA includes the Siltcoos Estuary, Dunes Overlook, and Tahkenitch Estuary, which are all adjacent to the ODNRA (ICF International, 2010). In both SPMAs and RMAs, recreation use restrictions include limiting recreation to wet sand, roping off key nesting sites, and prohibiting vehicles, dogs, and kites.

Siltcoos Beach Day Use Area

Within the federally adjacent RMA noted above is the Siltcoos Beach Day Use and OHV Staging area, located about 1.5 miles west of U.S. Route 101 and Dunes City, Oregon (Figure 1). In addition to providing important WSPL nesting habitat, Siltcoos Beach Day Use Area is a popular destination for visitors to the ODNRA. The site provides a paved parking lot and access to the beach via a short trail crossing over a large sand dune; from the peak of the sand dune, visitors typically choose to walk down the ocean side of the sand dune onto Siltcoos Beach. Due to restrictions in place during the WSPL nesting season on Siltcoos Beach, from March 15-September 15, visitors are required to walk directly to the wet sand and confine all activities to this area while they are recreating (Figure 2) (Siuslaw National Forest, 2018).



Figure 2. Wet vs dry sand on ODNRA beach. Per ODNRA WSPL restrictions, outdoor recreation was only permitted on the wet sand of Siltcoos Beach during data collection.

There are several existing signs to communicate WSPL beach restrictions to visitors; all of the existing signs were designed and implemented by the U.S. Forest Service (see existing signs in Appendix A). In the parking lot is a trailhead kiosk containing the “Share the Beach” interpretive sign about the WSPL (Figure 5), and the same “Share the Beach” sign is located approximately five meters from the top of the sand dune (see “treatment sign location” in Figure 6). Immediately after passing this sign, visitors are confronted with three additional signs related to WSPL restrictions located at the top of the dune. On the beach, roped fences delineate WSPL nesting habitat. These fences are constructed with yellow rope strung between posts in the sand; on each post is a small yellow sign reading, “Snowy Plover Nesting Area, No Entry Beyond This Point, March 15- September 15.” Generally, the fenced area extends from the elevated sand dunes to the upper high tide line. Although dry sand outside the rope is also closed during the WSPL nesting season, it is not possible to fence it given the daily change in ocean tides. In addition to signs, several volunteer docents communicate information about the WSPL to

recreationists throughout the nesting season. Many volunteers communicate this information along the beach, intercepting and speaking with visitors who are out of compliance with restrictions (U.S. Forest Service, 2017).

Treatment Signs

This study used three different signs to understand how visitors' attention, attitudes, and behavior were impacted by the sign's messages. All three signs encouraged visitors to walk on the wet sand of Siltcoos Beach to avoid WSPL nesting and foraging habitat and to reduce impacts to WPSLs.

Normative Sign

The Normative sign (Figure 3) was designed based on social norms research (Cialdini et al., 1990; Reno, Cialdini, & Kallgren, 1993) and utilized two descriptive norms ("Did you know 90% of people who visit Siltcoos Beach stay on the wet sand?") and showing visitors walking on wet sand) and two injunctive norms ("Walking on wet sand? Good job!" and showing characters smiling), ensuring both norms were congruent with one another (Cialdini, 2003). Based on the Focus Theory of Normative Conduct, the location of the sign at the entrance to Siltcoos Beach aimed to make both types of norms salient for visitors (Cialdini et al., 1990; Kallgren et al., 2000). Two reference groups (i.e., "fellow visitors" and "people who visit Siltcoos Beach") were utilized in the message to increase the efficacy of the sign (Goldstein et al., 2008). An actual photograph of Siltcoos Beach was used as the background of the sign to act as a retrieval cue (Goldstein & Cialdini, 2009). Finally, the sign also contained information on how visitor behavior leads to negative impacts on the WSPL (Bradford & McIntyre, 2007; Duncan & Martin, 2002; Lawhon, Taff, & Schwartz, 2016).



Figure 3. Normative sign

Narrative Sign

The Narrative sign uses a story about a girl who visits the beach to relay a persuasive message to visitors (Figure 4). Based on the E-ELM, this sign aimed to increase feelings of transportation and character identification by utilizing a narrative message structure (Moyer-Gusé, 2008). An additional aim of this sign was to induce feelings of empathy in the reader as a way to make the message more personally relevant and easier to centrally process (Campbell & Babrow, 2004). Similar to the Normative sign, this sign attributed impacts to WSPLs to visitor behavior and included a photograph of Siltcoos Beach to act as a retrieval cue (Goldstein & Cialdini, 2009).

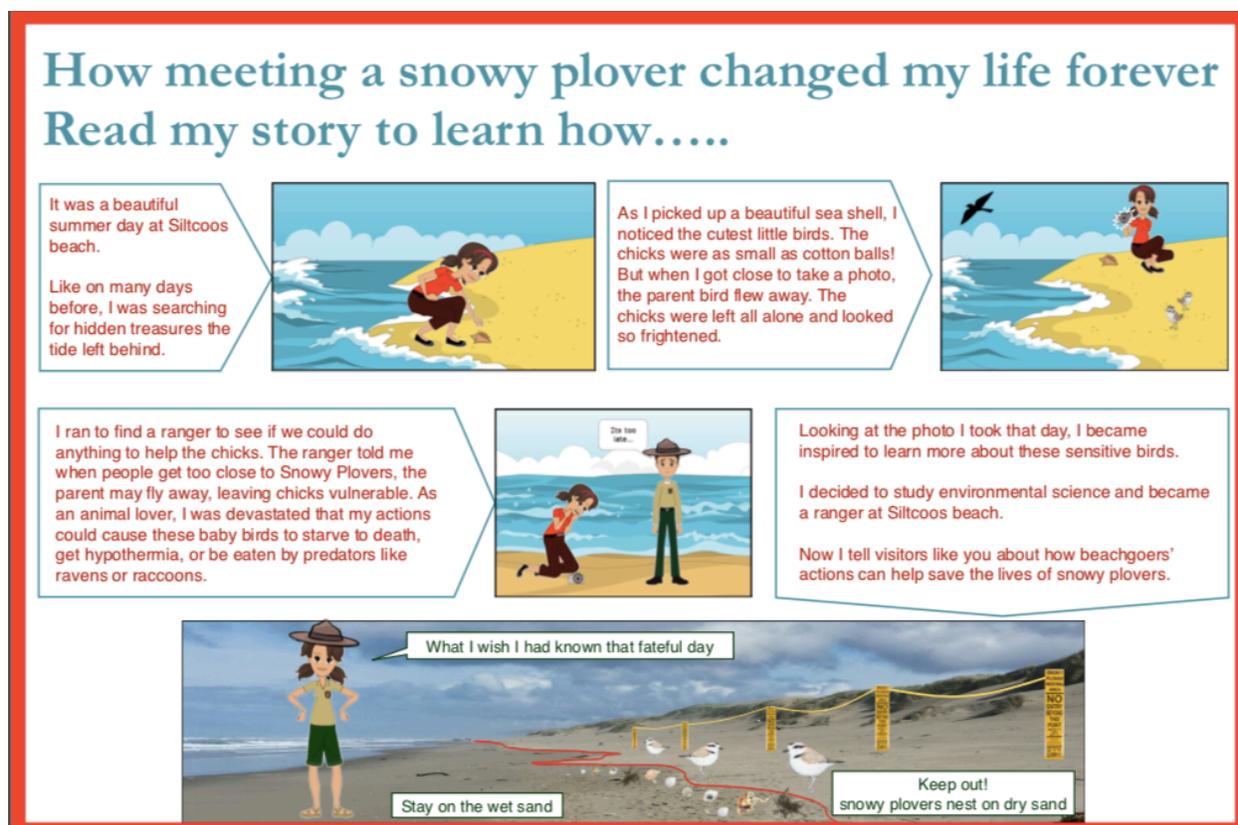


Figure 4. Narrative sign

Control Treatment: Existing Interpretive Sign

The control treatment was the existing “Share the Beach” sign present on the trail leading to Siltcoos Beach at the time of data collection (Figure 5). Similar to the Normative sign, the “Share the Beach” sign communicated a descriptive norm that it is acceptable for visitors to walk on the wet sand portion of the beach (Cialdini et al., 1990; Reno et al., 1993). Similar to the Narrative sign, the “Share the Beach” sign utilized an empathy approach (Campbell & Babrow, 2004) in the bottom right portion of the sign, which encouraged visitors to imagine what it is like to raise a family on the beach. Finally, similar to both the Normative and Narrative signs, the sign attributed negative impacts to WSPLs to human disturbance.



Figure 5. “Share the Beach” sign (control treatment)

Manipulation Checks

Following methods from Hall et al. (2010), manipulation checks were conducted on the Normative and Narrative signs to ensure each sign’s theoretical basis (e.g., social norms, narrative, empathy) was actually perceived by visitors. Additionally, it was important that visitors perceived certain attention capture design aspects as similar (e.g., red border, graphics, and provocative and brightly colored title). Throughout the course of the study, 100 manipulation checks (50 per sign) were administered via a convenience sample in three ODNRA sites north and south of Siltcoos Beach Day Use Area. Random assignment was used to assign either the Normative or Narrative sign to participants once they were intercepted. During each

manipulation check, visitors were asked to read the entire sign and respond to 12 statements measured on a 10-point scale from 1 (strongly disagree) to 10 (strongly agree). Examples of statements include “this sign communicates what other visitors are doing on beaches at the ODNRA,” “this sign communicates a story,” and “this sign catches my attention more than other signs I usually see here.” It was anticipated that six of the questions would result in statistically similar results and six questions would result in statistically different results (see full list of questions in Appendix B).

Additional data were collected measuring the total time needed to read each sign in full in November 2018, after completion of the July and August field season. These data were based on a convenience sample obtained via an email request. Respondents were requested to time themselves reading the each of the three signs with a stopwatch and report the exact number of seconds needed to read each sign in full. To assess how effectively each sign held visitors’ attention, the average amount of time needed to read the signs in full was compared to the average amount of time visitors read the signs in the field (see Data Collection section for discussion of attention holding).

Research Approach and Design

There were three separate data collection components of this study: sign viewing observations, wet vs. dry sand compliance observations, and a visitor survey. Together, these three components helped evaluate the effectiveness of the Normative and Narrative signs versus the existing “Share the Beach” sign (i.e., the control treatment) at Siltcoos Beach.

Sampling Plan

The population being studied for this research was adult visitors recreating at Siltcoos Beach. The sampling frame included Siltcoos Beach visitors entering and exiting the beach

during eight weekend days and 10 weekdays in July and August of 2018, the months where use was predicted to be highest. Each day of sampling was split into two sampling periods, the first occurring between 10:30 a.m. and 1:30 p.m., and the second occurring from 2:00 p.m. to 5:00 p.m.. In total, there were 36 sampling periods split among the three sign treatments.

Sampling Strategy

Due to relatively low use levels at Siltcoos Beach, a census sampling technique was attempted for the sign observation and survey components of the study, whereas a systematic sampling strategy was employed for the compliance observation component of the study. For the sign observation component, every adult who passed the sign located near the top of the sand dune was eligible for observation, regardless of whether they were alone or in a group. For the survey component of the study, every adult – as was possible– exiting the beach through the trail was intercepted to take the questionnaire. For the compliance observation component of the study, counts of all visitors in and out of compliance with the dry sand restriction (i.e., not walking on the beach’s dry sand) were conducted every 10 minutes, as was possible, from the beginning of each sampling period (i.e., 10:30 a.m. and 2:00 p.m.) until the end of each sampling period (i.e., 1:30 p.m. and 5:00 p.m.). It is important to note that, because the aim of this research was to assess the effectiveness of signs, it was imperative to ensure volunteer docents were not confounding the influence of the signs on recreationists. To minimize their influence, volunteers stationed at Siltcoos Beach were requested to refrain from communicating with recreationists during the hours of data collection unless visitors were drastically out of compliance with recreation use restrictions. Thus, it is possible that some visitors who spoke with a volunteer before the researcher arrived were included in the compliance observations, but for both the sign

observation and survey components of the study, respondents who spoke to a volunteer were omitted from analyses.

Data Collection

At the beginning of each sampling period, the researcher either attached the Normative or Narrative sign to the existing “Share the Beach” sign located near the top of the sand dune (covering it completely) or left the sign as-is if the control treatment was assigned to that sampling period. It should be noted the “Share the Beach” sign on the parking lot kiosk was in view throughout the entire study, regardless of which sign was exposed along the trail. The researcher then went to the unobtrusive observation location at the top of the sand dune and conducted sign observations, administered questionnaires, and counted compliance observations until the end of the sampling period.

Sign Observations

For the sign observation component, the researcher was stationed at an unobtrusive location that was out of sight of visitors entering the beach but offered a clear view of visitors passing within 5 feet of the sign. Following sign observation methods from Hall et al. (2010), the researcher categorized each visitor’s interaction with the sign into one of three behaviors: ignored, glanced (viewed for 2 seconds or less), or extended viewing (stopping and viewed the sign for 3 or more seconds). For visitors categorized as extended viewers, the researcher used a stopwatch to record the number of seconds during which the visitor viewed the sign. In addition to documenting visitor interaction with the signs, the researcher also documented visitor age, ethnicity, gender, group size, number of children, and number of dogs.

Compliance Observations

During compliance observations, the researcher counted how many visitors were on the wet sand and dry sand every 10 minutes throughout each sampling period. These counts were made from one stationary point on top of the sand dune and were conducted separately for three distinct sections of the beach: the “funnel” Zone (i.e., where people entered and exited the beach), Zone 1, and Zone 2 (Figure 6). The purpose of conducting compliance counts separately for Zone 1 and Zone 2 was that initial observations indicated that, rather than entering and exiting the beach at a 90-degree angle (i.e., through the funnel), some visitors entered and exited on a diagonal path through the funnel and Zone 1. Beyond Zone 1, Zone 2 was generally delineated by the distance to which the researcher could reliably judge whether visitors were in or out of compliance on the beach (Figure 6).



Figure 6. Siltcoos Beach Day Use Area map. Snowy plover recreation restrictions were not enforced north of the funnel zone. Basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Survey Instrument

For the self-administered survey component (see Appendix C), visitors were intercepted at the top of the sand dune as they left the beach. Once visitors agreed to participate in the study, they were asked to step off the trail to complete the questionnaire to be out of sight of visitors observing the sign. Past research on shorebirds and signs was utilized to create questionnaire items related to perceptions of threats to the WSPL (Polanan Petel & Bunce, 2012), attitudes about WSPL management actions (Jorgensen & Bomberger Brown, 2015), and perceptions of signs (Ormsby & Forsys, 2010). Quality questionnaire design principles were used to develop items from scratch measuring visitor concern for the WSPL, guilt for disturbing WSPLs, and perceived expected compliance from other visitors. It is important to note that this research used the term “attitude” liberally to encompass questionnaire items that may otherwise be defined as beliefs or knowledge. Though this conceptualization of attitudes runs in contrast to the strict definition of attitudes in the psychological literature (Gifford & Sussman, 2012), it is consistent with other shorebird literature which has defined attitudes more generally (Jorgensen & Bomberger Brown, 2015; Ormsby & Forsys, 2010; Polanan Petel & Bunce, 2012). Additionally, “snowy plover” was used throughout the questionnaire rather than “WSPL” because existing signs throughout the ODNRA use “snowy plover.”

Engagement with signs was measured with two items on a 7-point scale from 1 (not at all) to 7 (very): “How motivated were you to read the signs?” and “How engaging did the signs seem to you?” Attitudes regarding where visitors thought it was acceptable to recreate on the beach were assessed by asking respondents, “Where do you think it is acceptable for people to walk or sit at this beach?” with possible answers ranging from “dry sand inside fenced area” to “in the water”; respondents were asked to circle all options they thought were acceptable for

recreation. Attitudes regarding WSPL management actions were measured on a 7-point scale from -3 (strongly oppose) to 3 (strongly support) for seven items: “fencing off nesting areas along the beach,” “requiring visitors to recreate only on wet sand,” “closing off beaches entirely to recreational use when birds are present,” “volunteers communicating restrictions related to snowy plover protection on beach,” “prohibiting dogs from certain beaches,” “posting signs along beaches where snowy plovers nest,” and “fining people who do not comply with posted beach restrictions.” To assess visitors’ beliefs about threats to the WSPL, respondents were asked, “What is your opinion about the impact of the following items on nesting snowy plovers at this location.” Respondents were asked to respond to seven potential threats (e.g., disturbance by recreational visitors) on a 7-point scale from 1 (no impact at all) to 7 (severe impact). Though all threats were included because they have some impact on WSPLs, the primary purpose of the item was to assess visitors’ beliefs about disturbance from recreation since this was the topic of focus in all three signs tested. To assess general concern for WSPLs, respondents were asked “How personally concerned or not concerned are you about each of the following species in Oregon?” with “snowy plovers” listed as the third item; this question was measured on a 7-point scale from 1 (not concerned at all) to 7 (extremely concerned). Using a 7-point scale from 1 (not guilty at all) to 7 (extremely guilty), respondents were asked, “To what extent would you feel guilty or not guilty if you disturbed snowy plovers?” To assess expected compliance from other visitors, respondents were asked, “To what extent do you think other visitors expect you to comply with the posted restrictions at this beach?” measured on a 7-point scale from 1 (not at all) to 7 (very much). Lastly, the questionnaire asked respondents to report basic demographic information including their age, education, income, gender, and ethnicity (see full questionnaire in Appendix C).

A total of 440 questionnaires were collected with a response rate of 74% (Table 3). Using the survey log sheet, the following variables were used for conducting a non-response bias check: group size, age, gender, apparent ethnicity, number of children, and number of teens. The results of this check indicated that those who rejected the questionnaire were more likely to have larger group sizes ($t = 3.10$; $p = .002$; $r_{pb} = .14$), more young children (12 years old and younger) in the group ($t = 3.01$; $p = .003$; $r_{pb} = .14$), and be middle aged (ages 31-50) ($\chi^2 = 12.32$; $p = .006$; Cramer's $V = .16$); yet, there were no significant differences in apparent ethnicity, gender, or number of teens (13-17 years old) in the group.

Data Analysis

Attention Capture and Holding

To analyze the signs' ability to capture and hold attention, the percentages of visitors who ignored, glanced, or viewed the signs for an extended period of time (i.e., at least 3 seconds) were compared for the three signs using a chi-square test and Cramer's V to measure effect size ($p < .05$); using the decomposing method, additional chi-square tests were conducted to act as pairwise comparisons between the three signs. Another measure of attention holding was assessed by dividing each measured sign time from the extended viewers by the average time needed to read each sign. After calculating an average proportion of required reading time for each sign, these averages were compared using a Kruskal-Wallis test (a non-parametric test which compares the distribution centers) and a series of Bonferroni post-hoc tests. Self-reported engagement with signs was assessed using an index created from the two questionnaire items related to motivation to read signs and overall sign engagement; these two items were determined to be highly correlated and the internal consistency of the two items were examined using Cronbach's alpha reliability coefficient (reliability coefficient = .88, corrected item total

correlation = .79). Mean values for the self-reported engagement index were compared on the basis of which sign visitors reported seeing in the questionnaire (see explanation on groups below) using a Kruskal-Wallis test and Eta (η) to measure effect size, as well as for extended viewers and glancers using a Mann-Whitney U test and point biserial correlation (r_{pb}) to measure effect size.

Impact of signs on WSPL attitudes

Responses to attitude questions were compared based on which sign visitors saw that day (self-reported in questionnaire); these four groups were visitors who only saw the Normative sign, visitors who only saw the Narrative sign, visitors who only saw the “Share the Beach” sign, and visitors who reported seeing none of the three signs tested (i.e., visitors who didn’t see the Normative, Narrative, or “Share the Beach” signs but may have seen other signs at the beach). Visitor attitudes regarding acceptable locations to recreate on the beach were compared between the four groups using a series of chi-square tests. Visitor attitudes related to WSPL management actions, perceived impacts from threats to the WSPL, concern for the WSPL, guilt for disturbing WSPLs, and perceived expected compliance from other visitors were compared between the four groups using Kruskal-Wallis tests and a series of Bonferroni post-hoc tests. Because the research question assessing attitudes was intended to be focused on attitudes toward overall management rather than specific management actions, exploratory factor analysis (EFA) with varimax rotation was used to decide whether the seven items measuring respondents’ attitudes toward WSPL management actions should be analyzed as seven individual concepts or as a single concept. The EFA showed all seven items loading on a single factor, explaining 55% of the variance¹. Following this, a reliability analysis using Cronbach’s alpha was conducted to assess the internal

¹ Harmans single factor test was also conducted, resulting in an identical result as the original factor analysis. All seven items explained 55% of the variance.

consistency of the seven items. This analysis generated a Cronbach's alpha of .85, with corrected item-total correlations ranging from .53 to .69; removing any of the seven items would have reduced the overall alpha; thus none of the seven items were removed. Next, a single index was computed to represent respondents' overall attitude toward WSPL management actions; to be included in the newly computed index, respondents needed to answer at least four of the seven management attitude items.

Impact of Signs on Behavior

To determine how the signs impacted the rate of non-compliant behavior (i.e., failure to walk on wet sand), the first step was to determine which 10-minute compliance observations were associated with each of the three signs. Each of the 10-minute compliance observations was assigned to one of the three signs using the sign observation log sheets (showing when visitors entered the beach) and survey log sheets (showing when visitors left the beach). For example, if the researcher installed a sign at 10:30 and observed no one entering the beach until 11:00 (as shown on sign observation log sheet), one could assume anyone seen on the beach between 10:30 and 11:00 saw the "Share the Beach" sign, which was present until the researcher installed a different sign at 10:30. Out of 594 total 10-minute observations, 492 were assigned to one of the three sign treatments; from this group, 13 10-minute observations were omitted because they had confounded treatments. For instance, if there were observations assigned to two signs within one sampling period, either that sampling period was omitted altogether (e.g., if there were equal numbers of observations per sign), or the sign which had the most observations was chosen to represent that sampling period (i.e., hence omitting observations assigned to the other sign). In a few cases, because some sampling periods assigned to the Normative or Narrative signs included observations from the "Share the Beach" sign (i.e., from visitors who entered the beach before

researcher arrived and thus were exposed to the “Share the Beach” sign), observations from the “Share the Beach” sign were omitted such that the sampling period only included observations from the Normative or Narrative sign. Once compliance observations were assigned to one of the three treatments, a generalized linear model using a binomial logistic regression function, was conducted to determine if there were significant differences in the rates of non-compliant behavior among the three signs. These analyses were conducted separately for Zones 1 and 2.

Results

Manipulation Checks

In general, the manipulation check results (Appendix B) indicate the Normative sign was perceived as containing happier looking people than the Narrative sign, helping to confirm that participants perceived the injunctive norm of people smiling within the Normative sign. The Narrative sign was perceived as invoking empathy and conveying a story more than the Normative sign, showing participants perceived the empathy and narrative-based elements.

Both signs were perceived as similar in communicating the desired behavior of walking on the wet sand, being novel, catching attention, and having attention grabbing titles. Given that both signs utilized the same attention capture strategies gleaned from environmental interpretation literature (Moscardo et al., 2007), it was especially important that manipulation check results revealed statistically similar results for both attention capture questions. Given that both signs were perceived as similarly attention grabbing, any differences in the signs’ ability to hold attention can plausibly be attributed to the theory-based messages within each sign, rather than design features, such as utilizing bright colors in the title.

Attention Capture and Holding

Approximately 40% of visitors exposed to the Narrative sign and 30% of visitors exposed to the Normative sign were extended viewers, reading the signs for at least 3 seconds; yet, only 5% of people exposed to the “Share the Beach” sign read it for at least 3 seconds (Table 1). These differences were statistically significant ($\chi^2 = 92.00; p < .001$) and had a minimal to typical effect size (Cramer’s $V = .24$) (Vaske, 2008). The Narrative and Normative signs had statistically higher proportions of extended viewers compared to the “Share the Beach” sign. Additionally, there was a statistically larger proportion of extended viewers for the Narrative sign compared to the Normative sign. Therefore, there is evidence to suggest the Normative and Narrative signs captured attention much more effectively than the “Share the Beach” sign, and the Narrative sign captured attention slightly more effectively than the Normative sign.

Looking at the first measure of attention holding, the Narrative sign had the highest ratio of extended viewers (67%) to glancers (33%), and the Normative sign had the second highest ratio of extended viewers (55%) to glancers (45%). The “Share the Beach” sign had the most unfavorable ratio (Table 1). These differences were statistically significant ($\chi^2 = 24.89; p < .001$) and had a minimal to typical effect size (Cramer’s $V = .26$) (Vaske, 2008). Additional chi-squared tests indicate the Normative and Narrative signs had statistically larger ratios of extended viewers to glancers compared to the “Share the Beach” sign, and the Narrative sign had a statistically larger ratio compared to the Normative sign. Therefore, for this measure of attention holding, both the Narrative and Normative signs were more effectively than the “Share the Beach” sign. Additionally, it appears that Narrative sign was slightly more effective than the Normative sign in drawing readers to read the sign longer than three seconds.

Table 1. Percentages of visitors who ignored, glanced, or had an extended view of the signs at Siltcoos Beach Day Use Area

	Normative sign ^a n=320	Narrative sign ^b n=256	“Share the Beach” sign ^c n=216
Ignore (%) ¹	48	43	80
Glance (%) ¹	23	19	15
Extended viewing (%) ¹	29	39	5
<i>Only glancers and extended viewers</i>	Normative sign ^a n=166	Narrative sign ^b n=147	“Share the Beach” sign ^c n=44
Glance (%) ²	45	33	75
Extended viewing (%) ²	55	67	25

¹Statistically significant difference between sign treatments ($\chi^2=92.00, p<.001$, Cramer’s $V=.24$). Signs with different letter superscripts are significantly different at $p<.05$ based on chi-squared tests.

²Statistically significant difference between sign treatments ($\chi^2= 24.89, p<.001$, Cramer’s $V=.26$). Signs with different letter superscripts are significantly different at $p<.05$ based on chi-squared tests.

On average, visitors read the Narrative sign the longest, followed by the Normative sign, and then the “Share the Beach” sign (Table 2). For the mean proportion of required reading time, the second measure of attention holding, results showed that visitors read statistically more of the Normative (64%) and Narrative (65%) signs compared to the “Share the Beach” sign (28%) ($H = 9.84; p = .007; \eta = .20$) (Vaske, 2008) (Table 2). Yet, post-hoc testing reveals no statistically significant difference between the Normative and Narrative signs for mean proportion of required reading time. Therefore, for this measure of attention holding, the Normative and Narrative signs were similarly effective in comparison to the “Share the Beach” sign, which was less effective.

Table 2. Attention holding capacity of signs at Siltcoos Beach Day Use Area

<i>Duration of extended viewing</i>	Normative sign n=92	Narrative sign n=99	“Share the Beach” sign n=11
Mean (seconds)	14.1	33.9	10.5
SD	9.1	21.9	6.2
25 th Percentile	6.0	15.0	NA
50 th Percentile	14.5	30.0	NA
75 th Percentile	17.0	50.0	NA
<i>Number of seconds needed to read signs in full</i>	Normative sign n=20	Narrative sign n=20	“Share the Beach” sign n=20
Mean (seconds)	22.0	51.8	37.0
SD	4.7	17.5	9.8
<i>Proportion of required reading time</i>	Normative sign n=92	Narrative sign n=99	“Share the Beach” sign n=11
Mean (proportion) ¹	0.64 ^a	0.65 ^a	0.28 ^b
SD	0.42	0.42	0.17

¹Statistically significant difference between mean proportions ($H=9.84, p=.007, \eta=.20$). Means with different superscripts are significantly different at $p<.05$ based on post-hoc tests.

General Survey Information

Surveyed visitors to Siltcoos Beach Day Use Area had a relatively high level of education, with about 60% indicating they had completed at least a bachelor’s degree. Most surveyed visitors were also white (approximately 85% of all respondents). Additionally, approximately 65% of those surveyed indicated having a household income of at least \$50,000 per year, and almost 10% indicated an income of more than \$200,000 a year. The mean age of respondents was 44 (Table 3).

Table 3. Demographic information on survey respondents

Respondent Characteristic	
Education level, n=399	Percent
Some high school	1
High school graduate	10
Vocational or trade school certificate	3
Some college	14
Two-year college degree	11
Four-year college degree	34
Master's degree	18
PhD, JD, MD, or equivalent	9
Gender, n=420	
Male	51
Female	49
Ethnicity, n=417	
White	84
Hispanic or Latino	5
Asian	5
Other or prefer not to respond	5
American Indian	1
Black or African	0.7
I don't know	0.5
Native Hawaiian	0.2
Household Income before taxes, n=396	
Less than \$25,000	11
\$25,000-\$34,999	12
\$35,000-\$49,999	12
\$50,000-\$74,999	17
\$75,000-\$99,999	16
\$100,000-\$149,999	14
\$150,000-\$199,999	8
\$200,000 or more	9
Age, n=409	Years
Mean age	44.0
SD	16.7
Median age	42.0
Frequency of Use, n=437	Percent
First time user	68
Visited 1-2 times	21
Visited 3-5 times	5
Visited 6-11 times	3
Visited 11-20 times	1
Visited more than 20 times	3

Self-Reported Engagement with Signs

Based on Visitors' Sign Viewing Behavior

To examine self-reported engagement with the signs, visitors were asked to report how motivated they were to read the signs and their perceived level of sign engagement; these two items were combined into a single index. Looking only at extended viewers, there was no statistically significant difference in mean perceived engagement level between these two signs ($U = 248.00$; $p = .589$) (Table 4). Looking at both extended viewers and glancers, it appears the Normative and Narrative signs had similar levels of perceived engagement, and the two means were not statistically different ($U = 426.50$; $p = .919$) (Table 4). Therefore, this analysis indicates the Normative and Narrative signs were perceived to be similarly engaging by visitors.

Table 4. Self-reported engagement with Normative and Narrative signs. Cell entries are means on a 7-point scale from 1(not at all) to 7 (very).¹

Only extended viewers	Normative sign n=21	Narrative sign n=26
Mean	5.6	5.4
SD	1.0	1.2
Mean rank ²	25.2	23.0
Glancers and extended viewers	Normative sign n=28	Narrative sign n=30
Mean	5.2	5.3
SD	1.4	1.2
Mean rank ³	29.3	29.7

¹Sample sizes reflect individuals who both interacted with the signs and completed the survey (i.e., paired responses).

²No statistically significant difference between mean ranks ($U=248.00$, $p=.589$).

³No statistically significant difference between mean ranks ($U=426.50$, $p=.919$).

Based on Sign Visitors Reported Seeing

Comparing the mean self-reported engagement level between groups of visitors who indicated on the questionnaire that they saw different signs (Table 5), visitors who saw the Normative, Narrative, or “Share the Beach” signs had identical mean self-reported engagement levels compared to visitors who indicated seeing none of these three signs at the beach. Yet, none

of the four means were statistically different from one another ($H = 6.88$; $p = .076$), therefore results indicate the three signs were perceived to be similarly engaging.

Table 5. Perceived engagement level between groups of visitors who saw different signs. Cell entries are means on a 7-point scale from 1 (not at all) to 7 (very).

	Normative sign n=58	Narrative sign n=48	“Share the Beach” sign n=67	No signs n=84
Mean ¹	5.1	5.1	5.1	4.5
SD	1.4	1.5	1.6	1.8

¹No statistically significant difference between means ($H=6.88$, $p=.076$).

Impact of Signs on Attitudes

Where is it Acceptable to Recreate?

To assess whether the signs had an impact on visitors’ attitudes about recreating in WSPL habitat, visitors were asked to report what areas of the beach they thought were acceptable for walking or sitting. Though discussed earlier, it is worth repeating that, due to the wording of the question, it is possible visitors may have interpreted this question in two ways: (a) where they thought recreation was technically allowed (i.e., knowledge of WSPL restrictions), and (b) where they thought they should be able to recreate on the beach (i.e., attitude of WSPL restrictions). According to the ODNRA restrictions, recreation is only allowed on the wet sand, surf line, or in the water. The majority of respondents correctly thought the “wet sand between dry sand and surf line” was an acceptable place to recreate and “dry sand inside fenced areas” was an unacceptable place to recreate (Table 6). However, about half of respondents answered that recreating on the “dry sand between fenced areas and wet sand” was an acceptable place to recreate. Looking only at visitor responses related to the “wet sand between dry sand and surf line” item, there was no statistically significant difference between people in each sign viewing group ($\chi^2 = 1.09$; $p = .781$).

When examining responses to the “dry sand between fenced areas and wet sand” item, visitors who saw none of the three signs were the most likely to think recreating in the “dry sand between fenced areas and wet sand” was acceptable (72%), compared to visitors who saw the “Share the Beach” sign (55%), Normative sign (47%), and Narrative sign (34%) (Table 6). A statistically significant ($\chi^2 = 22.16; p < .001$) difference was identified between the four groups, with a minimal to typical effect size (Cramer’s $V = .28$) (Vaske, 2008). Additional post-hoc tests indicate visitors who saw any of the three signs were statistically less likely to think the “dry sand between the fenced area and wet sand” was an acceptable place to recreate compared to the group who saw none of the three signs. Additionally, visitors who viewed the Narrative sign were statistically more likely to think this area was an unacceptable place to recreate compared to visitors who viewed the “Share the Beach” sign. Overall, results suggest the signs had an impact on whether people thought the “dry sand between fenced areas and wet sand” was an acceptable place to recreate, with visitors who viewed the Normative and Narrative signs being the least likely to think this, followed closely by visitors who viewed the “Share the Beach” sign. In comparison to all three of these groups, visitors who saw none of the three signs were most likely to think recreating between the fence and the wet sand was acceptable.

Looking at responses to the “dry sand inside fenced area” item, visitors who saw none of the three signs (20%) were most likely to think recreating in the “dry sand inside fenced area” was acceptable, compared to visitors exposed to the “Share the Beach” sign (16%), Narrative sign (8%), and Normative sign (3%) (Table 6). These differences were statistically significant ($\chi^2 = 10.28; p = .016$), with a minimal to typical effect size (Cramer’s $V = .19$) (Vaske, 2008). Additional chi-squared test results show that visitors who viewed the Normative sign were less likely to report the “dry sand inside fenced area” as an acceptable place to recreate compared to

visitors who saw the “Share the Beach” sign or none of the signs. Otherwise, none of the additional chi-squared tests were statistically significant. Therefore, with the exception of the Normative sign, the other signs had no impact on visitors’ attitudes about whether the “dry sand inside fenced area” was an acceptable location for recreation.

Table 6. Knowledge of acceptable locations to recreate based on which sign visitors saw, reported as frequencies of responses (%)

	Normative sign n=60	Narrative sign n=50	“Share the Beach” sign n=69	Saw no signs n=97	All respondents n=436 ⁴
	<u>% of visitors who indicated the location was an acceptable place to recreate</u>				
Wet sand between dry sand and surf line ³	75	80	78	73	73
Along the surf line ³	63	68	70	58	60
Dry sand between fenced areas and wet sand ¹	47 ^{ab}	34 ^a	55 ^b	72 ^c	52
In the water ³	53	52	58	41	48
Dry sand inside fenced area ²	3 ^a	8 ^{ab}	16 ^b	20 ^b	12
I don’t know	0	4	7	7	5

¹ Statistically significant difference between four groups ($\chi^2=22.16, p<.001$, Cramer’s $V=.28$). Percentages with different letter superscripts are significantly different at $p<.05$ based on chi-squared tests.

² Statistically significant difference between four groups ($\chi^2=10.28, p=.016$, Cramer’s $V=.19$). Percentages with different letter superscripts are significantly different at $p<.05$ based on chi-squared tests.

³ Areas open to recreation according to ODNRA restrictions.

⁴ The 436 includes individuals that were unable to be assigned to the four sign groups (see section “impact of signs on WSPL attitudes”).

Attitudes toward WSPL Management Actions

To ascertain whether the signs had an impact on attitudes related to WSPL management actions, respondents were asked to report their level of support or opposition toward seven different management actions. Visitors who saw the Normative (6.0) and Narrative (6.0) signs had a similar positive attitude toward WSPL management actions (Table 7), but those who saw the “Share the Beach” sign (5.7) or saw none of the treatment signs (5.4) had less positive

attitudes of WSPL management actions. Results showed at least one of the groups' means was statistically different from the others ($H = 13.73$; $p = .003$), with a typical effect size ($\eta = .24$) (Vaske, 2008). Post-hoc test results showed that visitors who saw the Normative and Narrative signs had statistically different mean attitude levels compared to the group of visitors who saw none of the treatment signs; specifically, visitors who saw the Normative and Narrative signs reported more positive attitudes compared to those who saw none of the treatment signs. Yet there were no statistically significant differences among visitors who saw the Normative, Narrative, and "Share the Beach" signs, or a difference between visitors who saw the "Share the Beach" sign and none of the treatment signs.

Table 7. Attitude of WSPL management actions based on which sign(s) visitors saw, management attitude index. Cell entries are means on 7-point scale of 1 (strongly oppose) to 7 (strongly support).

	Normative sign n=60		Narrative sign n=50		"Share the Beach" sign n=69		Saw no signs n=97		All respondents n=429	
	Mean ¹	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overall attitude toward WSPL management actions ¹	6.0 ^a	0.9	6.0 ^a	0.7	5.7 ^{ab}	1.1	5.4 ^b	1.2	5.7	1.1

¹Statistically significant difference between four groups ($H=13.73$, $p=.003$, $\eta=.24$). Means with different letter superscripts are significantly different at $p<.05$ based on Bonferroni post-hoc tests.

Perceived Impacts from Threats to WSPL

Visitors were asked to report their opinion on the degree that seven threats impacted WSPLs to evaluate if the signs had an influence on perceived impact levels. Respondents believed, on average, that all potential threats listed in the questionnaire had at least some negative impact on the WSPL (Table 8). Respondents perceived "habitat loss" to have the most impact and "sea level rise" to have the least impact. When looking only at visitors' perceived

level of impact from “disturbance from recreational visitors,” those who saw the Normative (5.5) and Narrative (5.5) signs reported the same mean perceived level of impact, whereas visitors who saw the “Share the Beach” sign (5.0) or none of the treatment signs (4.8) perceived slightly less impact. Results indicated at least one of the four groups’ means was statistically different from one of the remaining three ($H = 10.22$; $p = .017$), with a minimal to typical effect size ($\eta = .20$) (Vaske, 2008). Post-hoc tests showed that visitors who saw either the Normative or Narrative sign perceived more impact from recreational visitors compared to visitors who saw no signs, and those who saw the Normative sign perceived more impact from recreational visitors compared to those who viewed the “Share the Beach” sign. Yet, there were no statistically significant differences between visitors who saw the Narrative and “Share the Beach” signs, “Share the Beach” sign and no signs, or the Normative and Narrative signs.

When looking only at visitors’ beliefs about the impact from “disturbance from dogs,” visitors who saw the Normative (5.9) and Narrative (6.0) signs perceived a similar mean level of impact, and visitors who saw the “Share the Beach” sign (5.5) or none of the treatment signs (5.3) perceived slightly less impact. At least one of the four groups’ means was statistically different from one the remaining three ($H = 9.63$; $p = .022$), with a minimal to typical effect size ($\eta = .19$) (Vaske, 2008). Post-hoc tests showed that visitors who saw the Normative and Narrative signs perceived statistically greater mean levels of impact compared to those who saw none of the treatment signs, but there was no significant difference between either the Normative and Narrative signs and the “Share the Beach” sign. Finally, there was no significant difference between the “Share the Beach” sign and the group of visitors who saw none of the treatment signs.

Table 8. Perceived impact of threats to WSPLs based on which sign(s) visitors saw. Cell entries are means on a 7-point scale from 1 (no impact at all) to 7 (severe impact).

	Normative sign n=63		Narrative sign n=58		“Share the Beach” sign n=93		Saw no signs n=121		All respondents n=430	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Habitat loss	5.9	1.3	5.7	1.6	5.8	1.6	5.4	1.7	5.7	1.5
Disturbance from dogs ¹	5.9 ^a	1.4	6.0 ^a	1.4	5.5 ^{ab}	1.6	5.3 ^b	1.8	5.5	1.7
Pollution	5.5	1.5	5.5	1.7	5.5	1.5	5.2	1.7	5.4	1.6
Disturbance by recreational visitors ²	5.5 ^a	1.4	5.5 ^{ab}	1.4	5.0 ^{bc}	1.7	4.8 ^c	1.7	5.0	1.6
Predation	4.8	1.5	4.7	1.7	4.8	1.4	4.3	1.7	4.6	1.6
Beach erosion	4.7	1.6	4.6	1.7	4.9	1.5	4.4	1.8	4.6	1.7
Sea level rise	4.4	1.8	4.5	1.9	4.7	1.6	4.3	1.6	4.4	1.7

¹Statistically significant difference between four groups' means ($H=9.63, p=.022, \eta=.19$). Means with different letter superscripts are significantly different at $p<.05$ based on Bonferroni post-hoc tests.

²Statistically significant difference between four groups' means ($H=10.22, p=.017, \eta=.20$). Means with different letter superscripts are significantly different at $p<.05$ based on Bonferroni post-hoc tests.

Concern for WSPL, Guilt for Disturbing the WSPL, and Perceived Expected Compliance From Other Visitors

Visitors were asked to rate their level of concern for the WSPL to assess whether concern levels changed based on which sign visitors were exposed to. Respondents reported they were moderately concerned about the WSPL (5.0) (Table 9), and visitors exposed to the Normative (5.2), Narrative (5.3), and “Share the Beach” (5.1) signs were more concerned about the WSPL than the group of visitors who reported seeing none of the treatment signs (4.5). Results indicated at least one of the four means was statistically different ($H = 10.83; p = .013$), with a minimal to typical effect size ($\eta = .22$) (Vaske, 2008). The post-hoc tests revealed that visitors who saw the Normative, Narrative, and “Share the Beach” signs had statistically higher levels of concern compared to the group of visitors who reported seeing none of the treatment signs.

Visitors were asked about the extent they would feel guilty if they disturbed WSPLs to see if the signs related to guilt levels. On average, visitors reported they would feel moderately guilty (5.8) if they disturbed a WSPL during their visit to the beach (Table 9), and those who saw the Normative (6.2) and Narrative (6.2) signs appeared to have identical mean levels of guilt that were higher compared to those who saw the “Share the Beach” sign (5.8) or none of the treatment signs (5.6). Results indicated at least one of the four means was statistically different ($H = 8.28; p = .040$), with a minimal to typical effect size ($\eta = .18$) (Vaske, 2008). The post-hoc tests revealed that those who saw the Normative and Narrative signs had statistically higher mean guilt levels compared to those who saw none of the treatment signs. Yet, there were no significant differences among the Normative, Narrative, and “Share the Beach” signs, or between the “Share the Beach” sign and those who saw none of the treatment signs.

Finally, visitors were asked if they thought other visitors expected them to comply with posted restrictions at the beach to evaluate the extent that the signs related to perceived social pressure to stay in compliance. No statistically significant difference was found between visitors who saw the treatment signs or no signs in terms of mean level of perceived expected compliance ($H = 6.02; p = .111$) (Table 9).

Table 9. Concern, guilt, and perceived expected compliance based on sign(s) visitors saw. For concern, cell entries are means on a 7-point scale from 1 (not at all concerned) to 7 (extremely concerned). For guilt, cell entries are means on a 7-point scale from 1 (not guilty at all) to 7 (extremely guilty). For perceived expected compliance, means are on a 7-point scale from 1 (not at all) to 7 (very much).

	Normative sign n=60		Narrative sign n=50		“Share the Beach” sign n=69		Saw no signs n=97		Overall sample n=431	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Concern for snowy plover ¹	5.2 ^a	1.5	5.3 ^a	1.7	5.1 ^a	1.9	4.5 ^b	2.1	5.0	1.9
Guilt for disturbing snowy plover ²	6.2 ^a	1.3	6.2 ^a	1.2	5.8 ^{ab}	1.6	5.6 ^b	1.8	5.8	1.6
Perceived expected compliance from other visitors ³	5.5	1.2	5.3	1.4	4.9	1.5	5.3	1.5	5.3	1.4

¹ Statistically significant difference between four groups’ means ($H=10.83, p=.013, \eta=.22$). Means with different letter superscripts are significantly different at $p<.05$ based on Bonferroni post-hoc tests.

² Statistically significant difference between four groups’ means ($H=8.28, p=.040, \eta=.18$). Means with different letter superscripts are significantly different at $p<.05$ based on Bonferroni post-hoc tests.

³No statistically significant difference between four groups’ means ($H=6.02, p=.111$).

Impact of Signs on Behavior

Although most visitors at this site were observed to be in compliance with the regulation to stay off the beach’s dry sand, 44% of visitors observed in Zone 1 (i.e., closer to the beach entrance) were observed to be out of compliance (i.e., walking or sitting on dry sand); in Zone 2, only 23% of visitors were observed to be out of compliance (Table 10). In part this was due to visitors walking south diagonally through Zone 1 from the funnel to Zone 2 (i.e., rather than traveling in a straight line through the funnel to the wet sand) and in part it was due to family groups who tended to stay in Zone 1 rather than wandering farther down the beach into Zone 2; because the funnel zone (where recreating on dry sand was allowed) was immediately next to Zone 1, it is possible families and large groups who recreated throughout the dry sand in Zone 1

were simply unaware they were out of compliance with the WSPL restrictions.

Table 10. Rate of non-compliant behavior (walking or sitting in dry sand)

	Zone 1	Zone 2
Count of non-compliant individuals in Zone ¹	224	282
Count of total individuals in Zone ¹	509	1235
Rate of non-compliance	44%	23%

¹individuals may have been counted at multiple time periods within a given Zone

The rate of non-compliant behavior was compared for visitors exposed to the Normative, Narrative, and “Share the Beach” signs. In Zone 1, compared to both the Narrative and “Share the Beach” signs, lower rates of non-compliant behavior were observed for visitors exposed to the Normative sign. However, this difference was not statistically significant ($\chi^2 = 1.81$; $p = .404$) (Table 11). For Zone 2, however, statistically significant differences in rates of non-compliant behavior were observed ($\chi^2 = 8.39$; $p = .015$); specifically, visitors exposed to the Narrative sign were significantly less likely to be out of compliance than those exposed to either the Normative or “Share the Beach” signs (Table 11).

Table 11. Binomial logistic regression to test for effects of signs on compliance with dry sand regulations

	Normative sign	Narrative sign	“Share the Beach” sign
Zone 1			
# individuals (non-unique) (n)	100	99	154
# Sampling periods (n)	9	9	9
# 10 min observations	132	119	150
Mean # 10 min observations per sampling period	12.0	10.8	15.0
Mean proportion of non-compliance	37%	56%	56%
95% Confidence Interval	18%-61%	33%-76%	37%-73%
Zone 2			
# individuals (non-unique) (n)	217	370	351
# Sampling periods (n)	10	12	10
# 10 min observations	149	162	154
Mean # 10 min observations per sampling period	13.5	13.1	15.4
Mean proportion of non-compliance ¹	28% ^a	13% ^b	31% ^a
95% Confidence Interval	17%-43%	7%-22%	22%-43%

¹Means with different letter superscripts are significantly different at $p < .05$ based on post-hoc pairwise z-tests.

Zone 1

Evidence of over dispersion: $\chi^2 = 5.597$, degrees of freedom = 24.

No statistically significant difference between mean proportions (Omnibus test: $\chi^2 = 1.81$, $p = .404$).

Zone 2

Evidence of over dispersion: $\chi^2 = 4.897$, degrees of freedom = 29.

Statistically significant difference between mean proportions (Omnibus test: $\chi^2 = 8.39$, $p = .015$).

Discussion

Signs are a common strategy for educating visitors about sensitive shorebirds in outdoor recreation areas (Ormsby & Forys, 2010; van Polanen Petel & Bunce, 2012). Signs have the potential to both increase visitor awareness about shorebirds (Ormsby & Forys, 2010) and increase the success of shorebird nesting through changing visitor behavior (Medeiros et al., 2007). Yet, because signs are often ignored in outdoor recreation areas (Hockett et al., 2017; Kidd et al., 2015), past research has emphasized the importance of grounding messages in social psychological theories and frameworks on how to best optimize message delivery and impact (Jorgensen & Bomberger Brown, 2015; Marion & Reid, 2007). Beyond theory-based messaging,

other research asserts a sign's effectiveness is largely dependent on how it is designed and thus perceived by the visitor as vivid, novel, and provocative (Hall et al., 2010; Moscardo et al., 2007). For managers who are reliant on signs to manage for depreciative behavior due to a lack of resources to implement other strategies, considerations to theory-based messaging and sign design are especially relevant; thus, this research asserts that it is worthwhile to further explore the extent to which novel and well-designed signs can effectively communicate with visitors. Consequently, the purpose of this research was to evaluate the impact of signs containing normative or narrative messaging on visitors' attention holding, attitudes about the WSPL and their management, and rate of depreciative behavior on the beach. Results of this study underline the importance of creating signs that are visually appealing and thus more likely to grab and hold visitors' attention, as both the Normative and Narrative signs captured and held attention more effectively than did the "Share the Beach" sign. Although the Normative and Narrative signs had only a small impact on visitor attitudes, for visitors who viewed the Narrative sign, there was a decreased rate of depreciative behavior on the beach (i.e., recreating on dry sand).

Impact of Signs on Attention

Arguably, a sign's message is only effective to the extent that it is read and processed by visitors. Both the Narrative and Normative signs captured and held attention more effectively than did the existing "Share the Beach" sign, even though they were the same dimensions and in the same location. As visitors approached the "Share the Beach" sign, only a small percentage read the sign for an extended period of time; for visitors who did take the time to read the sign, results suggested about one-third of the sign's content was actually read and processed before visitors continued walking. In comparison, at least one-third of visitors exposed to the Normative and Narrative signs stopped to read the signs for an extended period of time, and when visitors

did stop, they likely read about two-thirds of the signs' content, thereby increasing the potential for the signs' messages to make an impact.

However, consistent with previous research (Hall et al., 2010; Hockett et al., 2017), a large proportion of visitors ignored both the Normative and Narrative signs altogether. Though not measured in this study, other research has suggested that repeat visitors may be less likely to read signs because of established familiarity with the site (Hockett et al., 2017); moreover, because many visitors to Siltcoos Beach only stayed for a short time (i.e., only walked to the top of the dune before heading back to the parking lot), it is possible these visitors prioritized seeing the view of the ocean over spending time reading signs (Park et al., 2008).

The superiority of the Normative and Narrative signs in regard to attention holding could be partially attributed to effort taken in designing the signs according to environmental interpretation design principles (Ham, 1992; Moscardo et al., 2007). Both of these signs included several visual elements the "Share the Beach" sign lacked, including a bright red border, easy to read text, and a large, brightly colored, provocative title. Interestingly, the Narrative sign was the most effective in capturing and holding visitors' attention, despite the sign containing significantly more text than the Normative and "Share the Beach" signs; this finding runs in contrast to Petty et al. (1992), who argued that message length is negatively associated with attention holding.

Yet, this finding is consistent with at least one other study (Hall et al., 2010), that found a narrative sign was read more often and longer than other signs that did not contain a narrative. Given previous research showing that narratives create interest in a topic (Green, 2006; Green & Brock, 2000), character identification increases personal relevance (Campbell & Babrow, 2004; Cohen, 2001), and personally relevant messages are positively associated with attention holding

(Moscardo et al., 2007; Petty & Cacioppo, 1979; Petty et al., 1992), this finding is largely consistent with existing research on narrative messaging and attention holding. Furthermore, the Narrative sign was also designed to invoke empathy in viewers, and empathy has previously been shown to increase elaboration on a message (Campbell & Babrow, 2004), a concept likely related to attention holding; according to the manipulation check results (Appendix B), the Narrative sign was perceived as invoking empathy significantly more than the Normative sign.

Impact of Signs on WSPL Visitor Attitudes

Although the Normative and Narrative signs had nearly identical mean proportion of required reading times, the Narrative sign was more effective than the Normative sign in drawing readers in to read the sign longer than two seconds (as reflected in the extended viewer to glancer ratios). Yet, despite the Narrative sign holding attention more effectively than both the Normative sign or the “Share the Beach” sign, results demonstrated the sign had little to no impact on visitor attitudes related to the WSPL and its management. The only attitude measure that resulted in a statistically significant difference between the Narrative sign and “Share the Beach” sign was the measure asking visitors whether they thought recreating in the “dry sand between the fenced area and wet sand” was acceptable; for this item, visitors exposed to the Narrative sign were statistically less likely to report this area as acceptable. Although a significant difference was only found for one attitude measure, this result is supported by previous research suggesting that narrative messages can temporarily impact beliefs of viewers (Green & Brock, 2000; Slater & Rouner, 2002). Additionally, multiple studies have found empathy-based messages to be positively associated with pro-environmental attitudes (Berenguer, 2007; Swim & Bloodhart, 2014).

A potential reason why the Narrative sign failed to have a strong impact on visitor attitudes may be that this study was conducted in a field setting rather than a laboratory, a setting where many studies have documented a relationship between empathy-based messaging and pro-environmental attitudes (Berenguer, 2007; Schultz, 2000; Sevillano, Aragonés, & Schultz, 2007). In contrast to laboratory studies, the time between which visitors were exposed to the sign and completed the questionnaire could have ranged from several minutes to several hours in this field setting. One plausible reason for this result, as suggested by Slater and Rouner (2002), is that the persuasive impacts from the Narrative sign were short-lived, giving visitors ample time to forget the narrative they read earlier in the day. Hence, to maximize the impact of the Narrative sign on attitudes, these results suggest it would be prudent to place the sign as close as possible to where visitors decide whether or not to walk on the dry sand (i.e., on Zone 1 and Zone 2 of the beach), rather than placing the sign on the trail leading to the beach; alternatively, a similar result may be achieved by placing multiple signs with narrative messaging throughout Siltcoos Beach. Finally, it is important to note this study assessed the impact of the Narrative sign on attitudes based on what sign visitors reported seeing. Thus, using survey data alone, the extent that this group of visitors actually read the Narrative sign or experienced resulting transportation or character identification is unknown.

Similar to the Narrative sign, the Normative sign failed to have a substantial impact on attitudes compared to the “Share the Beach” sign. This result is not surprising in light of previous studies on normative messaging positing a direct relationship between this messaging and pro-environmental behavior, not pro-environmental attitudes (Cialdini et al., 1990; Reno et al., 1993). Yet, in comparison to the “Share the Beach” sign, results showed that visitors who reported seeing the Normative sign were less likely to report the “dry sand inside the fenced

area” as an acceptable place to recreate. Additionally, visitors who reported seeing the Normative sign were more likely to believe that recreation negatively impacted WSPLs compared to visitors who viewed the “Share the Beach” sign.

Although the relationship between the signs and attitudes was small, the Normative and Narrative signs were slightly more effective than the “Share the Beach” sign for impacting visitor attitudes regarding where it is acceptable to walk on the beach, showing these messages were somewhat helpful in educating visitors on the importance of walking on the beach’s wet sand for WSPL conservation. Yet, depending on which of the three signs visitors reported seeing, 34-55% of visitors still thought the “dry sand between the fenced areas and wet sand” was an acceptable place to recreate, suggesting that many visitors arrive to Siltcoos Beach with a predetermined script holding that recreating anywhere on the beach is acceptable (Werner et al., 1998). Hence, as other researchers have concluded (Hall et al., 2010), these findings further underline the importance of designing recreation area signs such that they grab visitors’ attention and effectively communicate their intended message.

Another noteworthy finding in regard to visitor attitudes is that approximately 30% of visitors surveyed reported seeing none of the three signs at the beach, despite the fact that at least one of the signs was in view when visitors entered the beach. Visitors who reported seeing none of the study signs were more likely to report the dry sand as an acceptable place to recreate and less likely to be concerned about the WSPL, have positive attitudes about WSPL management actions, and perceive recreation as having a negative impact on WSPLs. Although it is plausible this result is due to these visitors not seeing any of the signs, it is also possible that these visitors arrived at the beach already lacking concern about recreation area restrictions or sensitive species in general.

Impact of Signs on Beach Behavior

Throughout the observed zones at Siltcoos Beach, depreciative behavior took the form of visitors walking on the beach's dry sand where WSPLs are known to nest and feed (Page et al., 2009). Overall, results showed depreciative behavior was much higher in Zone 1 than Zone 2. The lower compliance rate in Zone 1 intuitively makes sense because visitors close to the beach entrance tended to be more dispersed, engaging in playing, socializing, and picnicking. In contrast, as visitors moved further from the beach entrance into Zone 2, they tended to predictably walk along the wet sand in a straight line. Looking at the impact of the signs, in Zone 1, there were no statistically significant differences in depreciative behavior between visitors exposed to any of the three signs. Despite a lack of statistical significance, the fact the Normative sign was observed to be the most effective compared to the Narrative or "Share the Beach" signs may be useful information to managers. As visitors made their way into Zone 2, results showed visitors exposed to the Narrative sign had a significantly lower rate of depreciative behavior compared to visitors exposed to the Normative or "Share the Beach" signs. This result adds to existing evidence (Medeiros et al., 2007) that signs can potentially effectively decrease depreciative behavior on beaches with sensitive nesting habitat.

Additionally, this result is consistent with the E-ELM, which posits that narrative messaging leads to narrative-consistent behaviors (Moyer-Gusé, 2008; Slater & Rouner, 2002). However, as was discussed previously, the Narrative sign had little impact on visitor attitudes, which is inconsistent with the E-ELM. Yet, visitors exposed to the Narrative sign were significantly less likely to report the "dry sand between the fenced area and wet sand" as an acceptable place to recreate compared to visitors exposed to the "Share the Beach" sign, providing evidence for an albeit weak relationship between a specific pro-environmental attitude

(i.e., whether the dry sand is acceptable for recreation) and a specific pro-environmental behavior (i.e., whether visitors decided to walk on the dry sand). Hence, this result is consistent with previous studies showing there is a stronger relationship between specific pro-environmental attitudes and pro-environmental behaviors (Bamberg, 2003; Mobley et al., 2010; Tanner & Kast, 2003) than between general pro-environmental attitudes and pro-environmental behaviors (Balderjahn, 1988). However, before combining the seven items measuring management attitudes into one index, no significant differences were found between the signs on the item measuring visitors' attitude toward "requiring visitors to recreate only on wet sand." Although this result seems to contradict the result observed on the "dry sand between the fenced area and wet sand" item, this difference could be due to visitors' tendency to have negative attitudes toward management actions that limit freedom of choice in a protected area (Manning, 2011). Beyond the narrative elements in the Narrative sign, it is also possible the empathy appeal helped impact visitors' choice to walk on the wet sand. Previous literature examining empathy messaging has found that putting people in a state of empathy makes them more likely to increase their intentions to perform pro-environmental behavior (Pahl & Bauer, 2013; Pfattheicher, Sassenrath, & Schindler, 2016).

The Normative sign's lack of impact on depreciative behavior stands in contrast to previous studies examining normative messaging and pro-environmental behavior (Cialdini et al., 1990; Reno et al., 1993). A potential reason for this discrepancy could be due to conflicting norms between those included in the Normative sign and descriptive norms that visitors observed on the beach. For example, if a visitor read the Normative sign communicating that walking on the dry sand is extremely uncommon and subsequently observed many people walking on the beach's dry sand, the descriptive norm on the beach may have been more salient and thus

overruled the normative messages on the sign. This idea was supported by both Cialdini (2003) and Smith et al. (2012) who emphasized the importance of keeping normative messages in alignment. Alternatively, the normative messages on the Normative sign could have been overshadowed by a situational norm, which can occur when there is a strong association between a particular behavior and a specific environment (Aarts & Dijksterhuis, 2003). In other words, visitors may have had a pre-existing association between the environment of a public beach and the freedom to recreate anywhere on that beach, especially given that most visitors, according to the questionnaire results, were visiting Siltcoos Beach for the first time.

Limitations

There are several limitations in relation to the “Share the Beach” sign, which was visible in the parking lot of Siltcoos Beach Day Use Area throughout the entire time the study took place. First, the very low rate of extended viewing for those exposed to the “Share the Beach” sign may have been partially due to visitors already reading the sign in the parking lot. Second, because the sample size was very small for “Share the Beach” extended viewers ($n=11$), it is possible that the true attention holding capacity of the “Share the Beach” sign reported may not be representative of the population to visitors to Siltcoos Beach. Third, it is possible that the higher rate of viewing for the Normative and Narrative signs was partially due to repeat visitors noticing a new sign had replaced the “Share the Beach” sign; indeed, the environmental interpretation literature suggests that signs with unexpected or surprising features are effective in grabbing attention (Moscardo et al., 2007). Lastly, because the “Share the Beach” sign contained some theory-based elements also within the Normative and Narrative signs (e.g., descriptive norm, empathy appeal), it is possible that visitors exposed to the Normative and Narrative signs may have been partially influenced by these elements from the “Share the Beach” sign in the

parking lot; however, the extent to which the theory-based elements in the parking lot “Share the Beach” sign influenced the results of the Normative and Narrative signs is unknown.

Additionally, unrelated to the “Share the Beach” sign, it is possible the three signs at the top of the dune may have influenced visitor attitudes and behavior since they contained information related to the WSPL beach restrictions; however, it is important to note these three signs likely had an equal influence on visitors since they were in place throughout the entire study.

Beyond the influence of signs, it is also plausible the volunteers’ presence on the beach, or simply the presence of a researcher who may have been mistaken for a volunteer, may have also influenced visitor behavior, regardless of whether or not the volunteers approached visitors. This idea is supported by studies which find depreciative behavior can be reduced simply by having a uniformed employee present in a recreation area (Swearingen & Johnson, 1995). Finally, given previous studies have found that signs were more effective when placed near the targeted behavior (Bradford & McIntyre, 2007; Johnson & Swearingen, 1992; Widner & Roggenbuck, 2000), it is likely the signs in this study could have had a stronger impact on depreciative behavior if they were placed on the beach itself rather than on the trail leading to the beach.

A notable limitation in the data analysis relates to how the compliance observations were assigned to the three signs. The sign observation and survey log sheets were used in concert to determine which sign that visitors on the beach were exposed to at any one time. Although several compliance observations were omitted from the behavior analyses due to uncertainty about which sign visitors on the beach had seen, it is possible that some compliance observations were inaccurately assigned, specifically on high use days when the researcher was more likely to deviate from the census sampling protocol.

Results of the non-response bias check showed that those who rejected the questionnaire were more likely to be middle aged (ages 31-50), have larger group sizes, and have young children (12 years old or younger) in their group; thus, although the effect sizes for these results are minimal, results may not be as generalizable to families with young children. Yet, there were no significant differences in ethnicity, gender, or number of teens between those who accepted or rejected the questionnaire. Additionally, because of the sampling design and the fact that the response rate and sample size were relatively high (74%), it is likely the results were generalizable to the population of visitors to Siltcoos Beach Day Use Area at the time of this study.

Finally, despite previous research indicating that frequent visitors may be less supportive of shorebird management actions compared to first time visitors (Jorgensen & Bomberger Brown, 2015; Maguire, Rimmer, & Weston, 2013), frequency of use was not controlled for when evaluating the effectiveness of the signs on attitudes. This decision was made because a large majority of the overall sample was comprised of first time visitors (about 70%). However, in future research looking at outdoor recreation areas with more variability in visitors' frequency of use, controlling for frequency of use may be warranted when evaluating the impact of signs.

Future Research

This research further underlines the importance of effective sign design and builds support for using narrative messaging to decrease depreciative behavior in outdoor recreation areas. Yet, it is important to look forward to new research questions that may clarify how theory-based messaging strategies can be made more impactful on visitors and, by extension, sensitive species such as the WSPL. Future studies should observe and survey the same individuals throughout their experience, such that a deeper understanding of the relationship between sign

viewing, attitudes, and behavior can be revealed. How does length of viewing time relate to subsequent attitude and behavior change? By comparing glancers and extended viewers on attitude and behavior change, more information can be gleaned about whether it is possible for a narrative message to be processed peripherally, or if central processing is required to have an impact on behavior.

Moreover, in seeing the Narrative and Normative signs effectively held visitors' attention, it would be useful to measure the extent that visitors elaborate on normative and narrative messages. A scale measuring elaboration developed by Vezeau, Powell, Stern, Moore, and Wright (2015) and later refined by Miller, Freimund, and Powell (2018) could be used for this purpose in future studies. Additionally, this study used a narrative about a person accidentally disturbing WSPLs, but future studies could test whether narratives about sensitive species themselves hold visitors' attention to a similar extent; are visitors more intrigued by a story from the perspective of a person or an animal? In finding the Narrative sign impacted behavior, but not attitudes, it could also be useful to measure visitor attitudes and behavior at different time intervals after sign viewing to grasp how many signs are needed in an outdoor recreation area to most effectively manage depreciative behavior. Finally, because personal contact has shown to be more effective than signs in decreasing depreciative behavior (Hockett et al., 2017; Kidd et al., 2015), future studies should explore the extent to which a narrative message delivered from park personnel influences depreciative behavior.

Management Implications

Results of this study suggest that interpretive signs are more successful at grabbing attention and changing behavior when they are visually stimulating and provide information through an engaging format, such as a narrative. This is an important finding given many

outdoor recreation managers have limited creative freedom when designing signs. For the U.S. Forest Service specifically, guidelines stipulate that most trail signs should be designed with white text on a brown background (U.S. Forest Service, 2013); though standardized formatting may result in easier creation and implementation of signs, signs using no graphics or attention grabbing features are more likely to be ignored and thus less likely to be effective for persuasive communication.

Yet, effective sign design and theory-based messaging may be limited to the extent they are capable of preventing negative impacts to natural resources, including sensitive wildlife. Indeed, none of the signs tested in this study were viewed 100% of the time or resulted in a 100% compliance rate on the beach. Given this result, it behooves managers at the ODNRA to assess what rate of non-compliance is low enough to adequately protect the population of WSPLs living at Siltcoos Beach (Hockett et al., 2017). Because the WSPL is a federally threatened species, even a small reduction in the rate of non-compliant behavior may be meaningful in terms of adherence to the U.S. Endangered Species Act and incidental take permit included in the WSPL Habitat Conservation Plan (ICF International, 2010).

More broadly, managers tasked with protecting any sensitive natural resource should assess the costs and benefits of using various management strategies such that there is a balance between the preferences of recreationists and what is necessary to protect the resource. Although indirect management strategies (e.g., signs, personal contact) may be preferred by visitors (Manning, 2011), it may be necessary to implement direct management strategies (e.g., physical barriers, permits, and area closures) if indirect strategies prove ineffective. For instance, neither signs nor personal contact may be appropriate in beach locations where noise from OHV's create

a distracting atmosphere where visitors may be less likely to elaborate on the message (Petty et al., 1992).

In the case of the ODNRA, current evidence related to shorebird management suggests that physical barriers should continue to be used to prevent impacts to WSPLs (Dowling & Weston, 1999; Lafferty, Goodman, & Sandoval, 2006; Vaske, Deblinger, & Donnelly, 1992; Wilson & Colwell, 2010). Furthermore, evidence from several off-trail hiking studies suggests that the highest rate of compliance may result from a combination of physical barriers and indirect management strategies, such as signs or personal contact from a volunteer or park ranger (Hockett et al., 2017; Lawhon, Taff, & Schwartz, 2016; Park et al., 2008).

Conclusion

There is little argument about the compelling nature of stories. Beyond permeating everyday conversations between friends and family, most people seek out stories to fill their free time, with many people spending multiple hours each day engaging in reading books or watching movies and television shows (Krantz-Kent, 2018). Given humans' natural affinity for stories and the ubiquity of narratives in modern society, it is reasonable to wonder if stories could also form an effective messaging vehicle for persuasion. Being one of the only studies to utilize narrative messaging to encourage pro-environmental behavior (Hall et al., 2010), this research demonstrated that narrative and empathy-based messages should be tested more widely in outdoor recreation settings where depreciative behavior is difficult to manage. Out of the three signs tested, the Narrative sign captured and held attention most effectively and was the only sign associated with a reduced rate of depreciative behavior on the beach (from approximately 30% for the Normative and "Share the Beach" signs to 13%), potentially mitigating disturbance to nesting WSPLs. Beyond use in outdoor recreation settings, narrative messaging could also be

adapted for a variety of contexts where organizations seek to use messaging to increase pro-environmental behavior (e.g., pledge drives for environmental organizations, public advertising campaigns on environmental issues). Given the striking rate of habitat loss and extinction rates worldwide, it is especially critical to utilize narrative messaging (and other novel types of messaging) to increase public support and funding for organizations working to protect and conserve wildlife. Interestingly, the Normative sign did not relate to a reduced rate of depreciative behavior on the beach in comparison to the “Share the Beach” sign. Though better sign placement may have increased the sign’s effectiveness (i.e., placing sign on the beach instead of the trail leading to beach), it is also plausible that normative messaging is not appropriate for outdoor recreation areas where visitors are dispersed and many, potentially conflicting, social norms are present relating to where it is acceptable to recreate.

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CHAPTER 3

CONCLUSION

This thesis explored how narrative and social norms messaging related to attention, attitudes, and behavior related to the threatened WSPL at a popular beach in the ODNRA. In one stand-alone article, this thesis investigated how narrative and social norms messaging in signs: (a) related to attention capture and holding for visitors to the ODNRA, (b) related to attitudes pertaining to the WSPL and their management in the ODNRA, and (c) impacted depreciative behavior known to disturb nesting and foraging WSPLs in the ODNRA.

Given that signs are often used by outdoor recreation area managers to educate visitors and reduce depreciative behavior (Manning, 2011), it is imperative to determine the most effective messaging strategies such that visitors can recreate without disturbing sensitive natural resources. Although it is generally acknowledged that signs based in communication theory are the most effective in changing visitor attitudes and behavior (Marion & Reid, 2007), studies using theory-based signs to reduce depreciative behavior have been somewhat but not perfectly successful (Marion, Dvorak, & Manning, 2008; Marschall, Granquist, & Burns, 2017; Park, Manning, Marion, Lawson, & Jacobi, 2008; Winter, 2006). Hence, this thesis contributed to the theory-based sign and messaging literature by employing a novel narrative messaging strategy and testing social norms messaging in a new way (i.e., including reference groups and retrieval cues). Results of this study can be used for informing future theory-based signs such that impacts to sensitive natural resources can be mitigated in outdoor recreation areas.

How the Signs Impacted Attention

Although research on environmental interpretation has emphasized the importance of using bright colors, illustrations, and provocative headings so signs effectively grab attention and are easy to read (Ham, 1992; Moscardo et al., 2007), many studies testing signs in outdoor recreation areas have not utilized such strategies, likely in an attempt to isolate the effects of the text-based message (Hall et al., 2010; Kidd et al., 2015; Marschall et al., 2017). Although there is often more leeway given to interpretive sign designers, researchers may also limit their use of graphic design features because of sign design guidelines set by federal agencies (U.S. Forest Service, 2013). However, at least two of the previously mentioned studies concluded that their communication messaging may have been more effective had attention been paid to the graphic elements of the sign (e.g., background color, illustrations, or fonts) (Hall et al., 2010; Marschall et al., 2017). Hall et al. (2010) even suggested that it is likely that visitors do not cognitively separate the “delivery system” of the message (i.e., graphic elements) and the message itself when perceiving and evaluating a sign. Hence, this study attempted to use several environmental interpretation design strategies equally on both treatment signs to maximize the impact of the theory-based messages.

Overall, this study found the design strategies used on the treatment signs were effective in capturing and holding visitors’ attention in comparison to the control sign. Given the treatment signs had a bright red border, bright colors, and a provocative heading (elements which the control treatment lacked), this study suggests similar elements should be included in future research testing signs in outdoor recreation areas. Furthermore, the Narrative sign held attention marginally better than the Normative sign, providing evidence that a narrative structure may further boost the attention holding capacity of a well-designed sign. This finding is consistent

with Hall et al. (2010), who found the narrative sign captured and held attention more than other types of messages. Yet, consistent with many studies on signs (Hall et al., 2010; Hockett, Marion, & Leung, 2017; Park et al., 2008), many visitors exposed to the treatment signs ignored the signs altogether, negating their potential impact on attitudes or behavior.

How the Signs Impacted Visitor Attitudes

Attitudes were examined in this study because of past research linking pro-environmental behaviors and attitudes (Bamberg, 2003; Mobley, Vagias, & DeWard, 2010; Tanner & Kast, 2003). Additionally, the conceptual models that formed the basis of the Narrative sign, the ELM and E-ELM, posit that the more a persuasive message results in elaboration on the message, the higher the probability the message will lead to attitude and behavior change (Petty & Cacioppo, 2012). Thus, following past research, attitudes related to the WSPL and their management were evaluated as a measure of sign effectiveness. Overall, the Normative and Narrative signs did not relate to visitor attitudes to a great extent in comparison to the control treatment, consistent with at least one other shorebird messaging study (Ormsby & Forys, 2010). Yet, both the Normative and Narrative signs significantly related to where visitors thought it was acceptable to walk on the beach, with visitors who reported viewing the treatment signs being significantly less likely to say the dry sand (i.e., area which was off limits) was an acceptable place to recreate on the beach compared to visitors who viewed the control treatment. Thus, despite the signs not relating to general attitudes on management and concern for the WSPL, it is still an important finding that the treatment signs related to the attitude most associated with depreciative visitor behavior at the ODNRA.

How the Signs Impacted Visitor Behavior

Additionally, the rate of depreciative behavior (i.e., walking on dry sand) was lower when the Narrative sign was in place compared to when the Normative or “Share the Beach” signs were in place, consistent with previous research linking specific pro-environmental attitudes to particular pro-environmental behaviors (Bamberg, 2003; Mobley et al., 2010; Tanner & Kast, 2003) and providing evidence for an attitude-behavior link in the E-ELM literature (Slater & Rouner, 2002). The fact that the Normative sign was not associated with a reduced rate of depreciative behavior runs in contrast to previous social norms messaging studies examining pro-environmental behavior (Cialdini, Reno, & Kallgren, 1990; Reno, Cialdini, & Kallgren, 1993), although these studies mostly focused on behavior related to recycling, littering, and energy conservation. As was discussed previously, this could have been due to a variety of reasons, including conflicting norms on the sign and on the beach itself (i.e., descriptive norm on beach overruled normative messaging on sign) (Cialdini, 2003; Smith et al., 2012), the existence of a situational norm leading people to assume recreating anywhere on the beach is acceptable (Aarts & Dijksterhuis, 2003), or use of injunctive-prescriptive and descriptive-prescriptive wording instead of injunctive-proscriptive wording, which has shown to be the most effective wording for reducing off-trail hiking (Winter, 2006).

Management Implications

Although the Narrative sign was associated with the lowest rate of depreciative behavior, similar to other studies using signs to change behavior in outdoor recreation areas, the Narrative sign did not result in a perfect compliance rate (Bradford & McIntyre, 2007; Winter, 2006; Johnson & Swearingen, 1992); about 13% of visitors exposed to the Narrative sign walked into the dry sand, putting nesting and foraging WSPLs at risk for disturbance. In light of this result,

managers at the ODNRA should consider what level of depreciative behavior is low enough to adequately protect WSPLs and safeguard compliance with the U.S. Endangered Species Act and the incidental take permit as outlined in the WSPL Habitat Conservation Plan (ICF International, 2010). To this end, it is recommended that signs only be used to supplement existing physical barriers, which have been shown to be more successful in preventing negative impacts to sensitive shorebirds (Dowling & Weston, 1999; Lafferty et al., 2006; Vaske et al., 1992; Wilson & Colwell, 2010). Many outdoor recreation studies support this conclusion in showing the lowest rates of depreciative behavior can be achieved through a combination of signs, personal contact, and physical barriers (Hockett et al., 2017; Lawhon et al., 2016; Park et al., 2008).

Future Research

Although the results of this study may be applicable to other beaches in the ODNRA or other Pacific Coast beaches with sensitive WSPL nesting habitat, managers should be cautious in extending results to other outdoor recreation areas with sensitive wildlife, especially given this research was only conducted at a single beach in Oregon. Thus, future studies should test similar signs at other protected areas to assess whether the findings of this study apply to other outdoor recreation settings or other types of depreciative behavior (e.g., off-trail hiking, dog waste disposal, wildlife feeding). Beyond replicating the study in a variety of settings, it would also be useful for future research to explore the relationship between specific levels of depreciative behavior and impacts to the WSPL. Following the management implications above, a future study could explore what rate of depreciative behavior is low enough to prevent nest failures or reduced fledgling numbers for WSPLs.

To improve narrative messaging, a logical next step would be to test the extent that narrative messaging is effective in changing attitudes and behavior via personal contact. Previous

studies that compared signs and personal contact consistently found personal contact to be a superior method in managing depreciative behavior (Hockett et al., 2017; Kidd et al., 2015; Marion et al., 2008), thus this may also be the case for narrative messaging. It may even be feasible to use a similar narrative to that which was used on the Narrative sign in this research. Depending on the extent that the storyteller conveyed genuine concern and emotion, it is likely that message recipients would find this type of message delivery more personally relevant and thus would be more likely to experience elaboration, empathy, character identification, and transportation. Given these factors are associated with persuasion and effective communication, it would also be worthwhile to measure the extent that message recipients experienced them after hearing the message; with additional monitoring of pro-environmental behavior, this robust study design would help to empirically validate the E-ELM.

Conclusion

In conclusion, as use levels increase throughout outdoor recreation areas, it is especially important for managers to employ creative and effective strategies to protect sensitive wildlife species. Specifically, improving low-cost communication tactics for reducing depreciative behavior is prudent given many recreation areas have recently experienced decreased funding for on-site staff (National Park Service, 2018). One of these low-cost tactics is signs, and although they are not always effective, this study illustrates that making signs more visually appealing and using narrative based messaging may increase their effectiveness to change behavior.

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APPENDICES

Appendix A: Existing Signs at Siltcoos Beach

A. Visible in parking lot

A1



A2



A3



A4



A5



B. Visible at top of dune

B1



B3



B2



B4



C. Visible on beach

C1



C3



C4

C2



Appendix B: Manipulation Check Results

Manipulation checks between Normative and Narrative signs

Variables ¹	Anticipated Result	Mean Normative	Mean Narrative	Mean Rank Normative	Mean Rank Narrative	<i>Standardized test statistic</i>	<i>p-value</i>	Effect size (r_{pb})
1) This sign communicates what other visitors are doing on beaches at the Oregon Dunes National Recreation Area	Normative higher	6.87	6.49	47.74	42.96	-0.87	.38	
2) This sign communicates what other visitors should do on beaches at the Oregon Dunes National Recreation Area	Normative higher	7.58	7.41	47.76	42.94	-0.88	.38	
3) The people in this photo appear to be happy	Normative higher	8.32	5.86	60.67	33.32	-5.00	<.001	.51
4) This sign communicates that people are supposed to walk on the wet sand, below the debris line, on Snowy Plover beaches	Normative and Narrative equal	7.97	7.80	44.50	44.50	0.00	1.0	
5) This sign makes me care about Snowy Plovers	Narrative higher	7.97	8.16	43.41	46.19	0.52	.61	
6) This sign seems novel	Normative and Narrative equal	6.89	7.06	42.28	45.27	0.55	.58	
7) This sign catches my attention more than other signs I usually see here	Normative and Narrative equal	6.66	6.12	47.49	43.15	-0.79	.43	
8) This sign encourages the reader to feel empathy for the Snowy Plover	Narrative higher	7.53	8.14	37.86	50.32	2.30	.02	.17
9) This sign communicates a story	Narrative higher	7.58	8.73	36.37	51.43	2.79	.01	.32
10) The sign communicates that people can cause Snowy Plover parents and chicks to become separated from each other	Normative and Narrative equal	8.03	8.78	38.39	48.93	1.99	.05	.20
11) The title of the sign is attention grabbing	Normative and Narrative equal	6.32	6.39	43.28	46.28	0.55	.59	
12) I wanted to read the entire sign	Normative and Narrative equal	7.66	6.43	51.63	40.06	-2.11	.04	.24

¹ Variables were measured on a 10-point scale from 1 “strongly disagree” to 10 “strongly agree”

Appendix C: Visitor Survey

These questions ask about your recreation at this site:

- 1) What were the purposes of your visit to the beach today? (*circle all that apply*)

a) Swimming/playing in ocean	e) Walking	i) Dog walking
b) Picnicking	f) Beachcombing	j) Surfing
c) Exercising	g) Fishing	k) Other (please specify): _____
d) Playing	h) Birdwatching	

- 2) Have you visited this beach before today?

No (*Go to question 3*)

Yes. Approximately how many trips have you made to this beach in the last year, including this trip?
(*please mark one*)

a) 1 - 2	d) 11 - 20
b) 3 - 5	e) More than 20
c) 6 - 10	

- 3) Did you interact with a Forest Service employee or volunteer on the beach today?

Yes

No

I don't know

- 4) Where do you think it is acceptable for people to walk or sit at this beach? (*circle all that apply*)

a) Dry sand inside fenced areas	d) Along the surf line
b) Dry sand between fenced areas and wet sand	e) In the water
c) Wet sand between dry sand and surf line	f) I don't know

- 5) How personally concerned or not concerned are you about each of the following species in Oregon?
(*please circle one response for each species*)

Species	Not At All Concerned					Extremely Concerned	
	1	2	3	4	5	6	7
a) Kelp	1	2	3	4	5	6	7
b) Coho salmon	1	2	3	4	5	6	7
c) Snowy plovers	1	2	3	4	5	6	7
d) Grey whales	1	2	3	4	5	6	7
e) Beavers	1	2	3	4	5	6	7
f) Crows and ravens	1	2	3	4	5	6	7

These questions ask for your knowledge and opinions about shorebirds:
--

(please check one response for each question)

	Yes	No	I don't know
6) Have you heard of the snowy plover?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7) Are snowy plovers found at this beach?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8) Are snowy plovers legally protected here?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- 9) To what extent would you feel guilty or not guilty if you disturbed snowy plovers?
(please circle one number)

Not guilty at all							Extremely guilty
1	2	3	4	5	6	7	

- 10) To what extent do you oppose or support the following management actions for snowy plover conservation on this beach? *(please circle one response for each action)*

	Strongly Oppose	Oppose	Neutral	Support	Strongly Support		
a) Fencing off nesting areas along the beach	-3	-2	-1	0	+1	+2	+3
b) Requiring visitors to recreate only on wet sand	-3	-2	-1	0	+1	+2	+3
c) Closing off beaches entirely to recreational use when birds are present	-3	-2	-1	0	+1	+2	+3
d) Volunteers communicating restrictions related to snowy plover protection on beach	-3	-2	-1	0	+1	+2	+3
e) Prohibiting dogs from certain beaches	-3	-2	-1	0	+1	+2	+3
f) Posting signs along beaches where snowy plovers nest	-3	-2	-1	0	+1	+2	+3
g) Fining people who do not comply with posted beach restrictions	-3	-2	-1	0	+1	+2	+3

- 11) What is your opinion about the impact of each of the following items on nesting snowy plovers at this location? *(please circle one number for each impact)*

	No impact at all						Severe impact
	1	2	3	4	5	6	7
a) Disturbance by recreational visitors	1	2	3	4	5	6	7
b) Disturbance from dogs	1	2	3	4	5	6	7
c) Sea level rise	1	2	3	4	5	6	7
d) Pollution	1	2	3	4	5	6	7
e) Habitat loss	1	2	3	4	5	6	7
f) Predation	1	2	3	4	5	6	7
g) Beach erosion	1	2	3	4	5	6	7

12) To the best of your knowledge, where do snowy plovers nest? (*circle all that apply*)

a) I don't know	e) In the water
b) Dry sand inside the fenced area	f) In the sand dunes away from the beach
c) Dry sand between fenced area and wet sand	g) In trees
d) Wet sand between dry sand and water	

13) What do you think happens when people approach snowy plovers? (*circle all that apply*)

- a) I don't know
- b) They run or fly away
- c) They usually don't react to human presence
- d) The chicks run toward the water
- e) The parents and chicks can become separated
- f) The chicks camouflage themselves in the sand
- g) The parents pretend like they've injured their wing as a distraction
- h) They become aggressive

14) To what extent do you think other visitors expect you to comply with the posted restrictions at this beach? (*please circle one number*)

Not at all							Very much
	1	2	3	4	5	6	7

15) To the best of your ability, please indicate which of the following birds is a snowy plover: (*circle all that apply*).

a)



c)



b)



d)



e) I don't know

The following questions ask about information you obtained about this site:

16) Did you see any signs when you got close to the beach or on the beach itself?

- Yes
 No (*Go to Question #24*)
 I don't know (*Go to Question #24*)

17) Please briefly describe the messages you got from the signs you saw:

**These questions ask about the signs you saw at the top of the trail to the beach, not in the parking lot.
 (If you did not see any signs, please go to Question #24)**

	Not at all						Very
18) How motivated were you to read the signs?	1	2	3	4	5	6	7
19) How engaging did the signs seem to you?	1	2	3	4	5	6	7

20) What information was on the signs? (*circle all that apply*)

- a) I don't know
- b) Information about where dogs are allowed on beaches
- c) Information about where OHVs are allowed
- d) Information about tsunamis
- e) Information about sanderling birds
- f) Information about snowy plovers
- g) Information about ravens and crows

21) How did you perceive the tone of the signs?

Very negative Very positive

1	2	3	4	5	6	7
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22) How did the signs make you feel? (*please circle one response for each item*)

	Not at all						Very
a) Guilty	1	2	3	4	5	6	7
b) Hopeful	1	2	3	4	5	6	7
c) Informed	1	2	3	4	5	6	7
d) Fearful	1	2	3	4	5	6	7
e) Happy	1	2	3	4	5	6	7
f) Confused	1	2	3	4	5	6	7

23) Please indicate which of the following signs you saw at the beach today?
(circle all that apply)



f) I didn't see any of these signs

Finally, we have a few demographic questions, to help us describe our study participants:

24) Please indicate the highest level of formal education you have completed (select one)

a) Less than high school	f) Two-year college degree
b) Some high school	g) Four-year college degree
c) High school graduate	h) Master's degree
d) Vocational/trade school certificate	i) Ph.D, M.D., J.D., or equivalent
e) Some college	

25) What year were you born? _____

26) Please indicate your gender (*select one*)

- a) Male
- b) Female
- c) Other _____

27) What is your ethnicity?

a) Hispanic or Latino	e) Native Hawaiian or other Pacific Islander
b) American Indian or Alaska Native	f) White
c) Asian	g) Other/Prefer not to respond
d) Black or African	h) I don't know

28) Which category best represents your annual household income before taxes? (*select one*)

a) Less than \$25,000	e) \$75,000 to \$99,999
b) \$25,000 to \$34,999	f) \$100,000 to \$149,999
c) \$35,000 to \$49,999	g) \$150,000 to \$199,999
d) \$50,000 to \$74,999	h) \$200,000 or more

Do you have any other comments you'd like to make?

Thank you very much for your help with our study!

If you'd like more information, the survey administrator would be happy to answer any questions.