

Atlantic Flyway Disturbance Project



• Social Science Report •
Part II: Understanding Beach Recreationists

- **Report prepared by** •
Carolyn Comber and Dr. Ashley A. Dayer
Virginia Tech
Department of Fish & Wildlife Conservation
- **Cover photo credit** •
Michaela Fisher

This study was funded by the National Audubon Society through a grant awarded by the National Fish and Wildlife Foundation



Audubon

- **With significant contributions from** •

Walker Golder (National Audubon Society)
Dr. Daniel Catlin (Virginia Tech Shorebird Program)
Dr. Daniel Gibson (Virginia Tech Shorebird Program)
Kelsi Hunt (Virginia Tech Shorebird Program)
Michaela Fisher (Field Technician)

- **With special thanks to** •

The dog walkers of New York, Maine, and South Carolina who participated in this study

USFWS

Deb Reynolds, Cindy Fury, Rebecca Longenecker, and Caleb Spiegel

Maine

Lindsey Tudor (Maine Dept. of Inland Fisheries and Wildlife), Laura Minich Zitske (Maine Audubon), the Town of Kennebunkport, the Town of Kennebunck, the Town of Old Orchard Beach, the Town of Wells, Rachel Carson NWR

New York

The Town of East Hampton and Audubon New York

South Carolina

Nolan Schillerstrom (Audubon South Carolina), Lori Sheridan Wilson (Deweese Island), the Town of Sullivan's Island, The City of Isle of Palms

Table of Contents	
Executive Summary	2
Background	2
Methods	2
Results	2
Future Directions	3
Introduction	4
Methods	6
Focus on Dog Leashing Behavior	6
Literature Review	6
Observational Study	7
Dog Walker Interviews	7
On-site Survey: Construction	7
On-site Survey: Implementation	8
Survey Analysis	9
Results	10
Literature Review	10
Survey Response	10
Respondent Demographics	10
Leashing Behaviors	12
Barriers and Benefits	13
Norms and Attitudes Towards Leashing Dogs	14
Trust of Information Channels	16
Preference for Receiving Information about Beach Management	16
Future Directions	17
Recommendations for CBSM Strategy Development	17
Next Steps	21
Literature Cited	23
Appendix A: Research Site Characteristics	26
Appendix B: Chi-Square Values of Characteristics, Trusted Sources for Information, and Preferred Information Channels of Dog Walkers	30
Appendix C: Independent Sample T-test of Benefits and Barriers to Leashing Dogs, Norms, Attitudes, and Leashing Behaviors of Dog Walkers	31
Appendix D: Dog Walking Interview Script	32

Executive Summary

Background

Human disturbance is one of the most significant threats to breeding, migrating, and wintering shorebirds. Many biological studies have been conducted to understand how human disturbance can impact shorebirds; however, there have been limited efforts to understand the drivers of human behavior that may impact shorebirds and how to change that behavior. Using a community-based social marketing (CBSM) approach, we explored how to effectively work with beach recreationists to reduce the threat of human disturbance.

Methods

The first step in CBSM is to select a sustainable behavior to promote that will directly result in the desired outcome (e.g. reducing human disturbance to shorebirds). For this phase of research, we selected voluntarily leashing dogs on beaches where dog walkers have the choice to let their dogs off leash. We chose this behavior to promote based on our past work with managers in the Northeastern United States (Mengak, Dayer, Longenecker & Spiegel, 2019), as well as literature about the impacts of dogs on shorebirds, and the appropriateness of this behavior for CBSM.

The second step of CBSM is to analyze the barriers and benefits to a behavior. To understand what prevents beach recreationists from leashing dogs on beaches and to understand what benefits they receive from taking this action, we reviewed relevant literature, observed beach recreationists engaging in dog walking on beaches, and conducted interviews with dog walkers. Using this information, we created a survey to assess the barriers and benefits at a Flyway-wide scale. We administered the survey from July through October 2018 to 1,215 beach recreationists with experience walking dogs at beaches in Maine, New York, and South Carolina. We attempted to approach all dog walkers we encountered on the beach; however, at times, we could not reach everyone due to too many dog walkers on the beach for our two survey administrators or some dog walkers entering or leaving beaches before we could intercept them. Our decline rate of those we asked to take the survey was only 12%. In this report we compare the responses of those who were walking dog(s) off leash (n = 563) to those who were walking their dog(s) on leash (n = 498).

Results

The perceived benefits to leashing dogs at the beach are that leashing prevents dogs from running into areas for beach nesting birds and leashing prevents dogs from bothering other people. The perceived barriers are that dog walkers feel that it is not necessary to leash their dogs and leashing prevents dogs from freely exercising and socializing. Additionally, most dog walkers believe dog walking should be controlled for the protection of shorebirds and they would feel bad if they walked their dogs near nesting shorebirds. Yet, dog walkers do not tend to believe that their dogs would be a threat to shorebirds. Dog walkers have a strong preference for receiving information via signs and websites. Also, dog walkers trust non-profit organizations for information on beach management.

Future Directions

Using the information from our benefits and barriers analysis, we recommend co-developing a strategy for leashing dogs with land managers who would be interested in implementing a strategy. The strategy should focus on reducing the barriers and increasing the benefits of leashing dogs on beaches (CBSM third step), while keeping in mind the local social and ecological context. This strategy might include zoning certain portions of beaches or even entire beaches for beach recreationists to walk their dogs off leash for dogs' exercise. If these areas are strategically created at locations that are less suitable for shorebirds, then dog walkers can receive the benefits of letting their dogs off leash and shorebirds can be better protected by preventing dog walkers from taking dogs to more sensitive areas that are valuable for shorebirds. Such an approach would be best informed by a better understanding of the barriers and benefits managers face when implementing new zoning schemes, or the benefits and barriers that dog walkers would face if they had to use an alternate location to the one they are accustomed to. In addition to zoning certain portions of beaches, a variety of CBSM tools could be employed to encourage people to voluntarily leash dogs. We present strategies for communications (e.g., signs), commitment (e.g., pledge), norms (e.g., display of photos of leashed dogs), incentives (e.g., amenities for dogs at a dog beach), and social diffusion (e.g., working with a trusted vet to share their image as a leashed dog walker). These approaches could be used alone or in combination, depending on resources and needs at a certain site.

Preferred information tools (e.g., signs, websites) and trusted sources (e.g., non-government wildlife agencies) are recommended to effectively execute the strategy. If the strategy involves zoning paired with CBSM tools, then messaging about the new zoning procedures could be shared with beach recreationists, emphasizing the dual importance of maintaining off leash access for dogs on beaches and protecting shorebirds in key areas. We recommend a pilot test of such a strategy (CBSM fourth step) along the Atlantic Coast, possibly focusing on low-performing beaches due to dogs (see Biological report). After the strategies from step 4 have been demonstrated to be effective, a pilot test can be conducted in concert with an evaluation of biological and social results (CBSM fifth step).

Introduction

Each year shorebirds travel across the Atlantic Flyway, undertaking some of the longest recorded migrations. During their migrations, shorebirds rely on coastal habitats along the Atlantic Coast for areas to forage, rest, and breed (Winn, Brown, Spiegel, Reynolds, & Johnston, 2013). In addition to shorebirds, the Atlantic Coast is also home to more than 1/3 of the population of people within the United States, which has grown by 84% since 1960 (National Audubon Society, 2019; Wilson & Fischetti, 2010). As a result of this coastal urbanization, beaches face several pressures from human activities (Brown & McLachlan, 2002) and although often unintentional, some human activities can have negative impacts on shorebirds (USFWS, 1996; 2012; 2014). Mengak, Dayer, Longenecker, & Spiegel (2019) defined human disturbance to shorebirds as:

A human activity that causes an individual or group of shorebirds to alter their normal behavior, leading to an additional energy expenditure by the birds. It disrupts or prevents shorebirds from effectively using important habitats and from conducting the activities of their annual cycle that would occur in the absence of humans. Productivity and survival rates may also be reduced.

Human disturbance is one of the most significant threats to shorebirds (AFSI, 2015; NFWF, 2018). This disturbance has been well documented by researchers who have found that activities such as beach driving (Melvin, Hecht, & Griffin, 1994), boating (Burger, Gochfeld, Jenkins, & Lesser, 2010), walking (Sabine, Meyers, Moore, & Schweitzer, 2008.), flying aircraft, (Visser, 1986; cited in Smit & Visser, 1993), and dog walking (Lafferty, 2001b) can reduce shorebird populations directly and/or indirectly. Although most dog walkers do not perceive their dogs to be a threat to shorebirds (Williams et al., 2009), it has been well documented that dogs can have deleterious effects on birds (Banks & Bryant, 2007). Dogs have been shown to impact breeding shorebirds and their young by preying upon chicks and adults, crushing eggs, and inducing anti-predator behaviors in adults, which can lead to temporary abandonment of eggs or chicks (Lafferty, 2001a, 2001b; Weston & Elgar, 2007; Williams et al., 2009). Temporary abandonment can lead to a series of indirect impacts on shorebird eggs and young such as increased risk of predation, thermal stress, and trampling, which can reduce nest and chick survival over time (McGowan & Simmons, 2006; Sabine et al., 2008; Borneman et al., 2016; Fleming et al., 1988; Ruhlen et al., 2003).

Dogs can also have direct impacts on shorebirds by inflicting mortality. In a recent case in Maine, a piping plover chick was found dead after being attacked by a dog (Antonacci, 2013), and at Sleeping Bear Dunes National Seashore, a female adult piping plover carcass was found torn apart by a dog (Roebuck, 2017). Migrating and wintering shorebirds are also negatively impacted by dogs through displacement from foraging and roosting habitats. For instance, at a migratory stopover on Delaware Bay, New Jersey, shorebirds responded to the presence of dogs by flushing and did not return for well over ten minutes (Burger, Carlucci, Jeitner, & Niles, 2007). During one study in Australia, researchers found that dogs and people significantly reduced the

presence of shorebirds in a study area and the impact of dogs was twice as great as the impact from people (Stinger, Beyer, Klein, & Fuller, 2016).

In response to these threats, guidelines have been developed to reduce disturbances. For example, in recovery and management plans, the USFWS outlines guidelines for managing recreational activities in piping plover habitats and provides information on fencing, delineating buffer zones, and restricting activities near nesting areas (USFWS, 1996; 2012). Similarly, the *American oystercatcher conservation action plan for the United States Atlantic and Gulf Coasts* highlights major threats to American Oystercatchers such as the presence of dog walking and describes activities that could reduce disturbances such as identifying and protecting existing habitat, creating new habitat, and monitoring the population status of American oystercatchers (Schulte, Brown, Reynolds, & the American Oystercatcher Working Group, 2007).

Through the guidance of conservation plans, land managers try to change human behavior, specifically behaviors relating to dog walking. For example, managers fully or partially close beaches to dog walking (Comber & Dayer, 2019), institute mandatory leash laws that dictate how far dogs must be restrained and enforce buffer distances that prohibit dogs from being within the vicinity of shorebird nesting areas (USFWS, 1996; Melvin et al., 1991). Although these restrictions are intended to protect shorebirds from dogs, researchers have found that people are not always receptive to these restrictions and often disregard them (Williams et al., 2009, Jorgensen & Brown, 2014).

According to land managers across the U.S. and Canadian portions of the Atlantic Flyway, compliance is particularly low for restrictions relating to dog walking. This might be because there is a lack of law enforcement across the Flyway and since officers are spread thin, they are not able to adequately enforce restrictions (Comber & Dayer, 2019). The lack of compliance with restrictions relating to dog walking may also be because the associated information campaigns are ineffective at improving awareness, attitudes, and compliance (Jorgensen & Brown, 2015). Several studies have shown that simply providing information is not sufficient to produce sustainable behavior change (Geller, 1981; Midden et al., 1983; Jordan, Hungerford, & Tomera, 1986, Geller, Erickson, & Buttram, 1983). Rather, initiatives that are delivered at the community level and that focus on removing barriers to the behavior, while simultaneously enhancing the behavior's benefits, are more likely to bring about change in behaviors that reduce human disturbance to shorebirds than those focused solely on provision of information (McKenzie-Mohr, 2011).

One such approach to developing campaigns to effectively promote conservation behavior change is community-based social marketing (CBSM). This approach consists of five steps that involve: 1) selecting a behavior to promote behavior change; 2) identifying barriers and benefits to that behavior; 3) developing a strategy to address the barriers and benefits; 4) piloting the strategy; and 5) implementing and evaluating the strategy (McKenzie-Mohr, 2011). In collaboration with Audubon and the Atlantic Flyway Shorebird Initiative, we identified leashing dogs as a behavior change to promote. Then we undertook social science research as the next step, focused on the following research questions.

Research Questions:

1. What are the barriers and benefits perceived by recreationists to leashing dogs on beaches?
2. What attitudes and norms do beach recreationists have towards leashing dogs for the protection of shorebirds along the Atlantic Flyway?
3. What are recreationists' preferred information channels and sources of information about beach management?

Methods

Focus on Dog Leashing Behavior

In collaboration with Audubon and the Atlantic Flyway Shorebird Initiative, we identified leashing dogs as a behavior to promote since leashing has been shown to reduce the number of birds disturbed and the probability of disturbance (Lafferty, 2001a). Further, in our land manager survey, unleashed dog walking was reported to occur at 85% of the surveyed sites within the last five years and managers believed that out of all the potential human disturbances, unleashed dog walking had the most non-compliance followed by leashed dog walking (Comber & Dayer, 2019). We focused on uncovering the barriers and benefits to voluntarily leashing dogs on beaches. Barriers refer to anything that reduces the probability of engaging in the target behavior, and benefits refer to a person's beliefs about the positive outcomes associated with the behavior (Schultz, 2013). Therefore, in this study, we consider barriers to be any obstacles or circumstances that recreationists believe prevent them from leashing dogs on beaches, and benefits are any advantages or gains that beach recreationists believe they receive from leashing dogs on beaches. To understand what prevents beach recreationists from leashing dogs on beaches and to understand what benefits they receive from taking this action, we conducted the following: 1) a review of relevant literature; 2) observations of beach recreationists engaging in dog walking on beaches; 3) interviews with dog walkers; and 4) on-site surveys of beach recreationists along the United States portion of the Atlantic Flyway.

Literature Review

As part of this project, we conducted a comprehensive literature review on disturbance to breeding, migrating, and wintering shorebirds along the Atlantic Flyway. For topics where there was limited research along the Atlantic Flyway, we also included pertinent information from other areas around the world. Similarly, for topics where there was minimal research related to shorebirds, we included information related to non-shorebird, coastal species. We conducted the literature review in 2017-2018. We started by searching for articles related to the Atlantic Flyway Shorebird Initiative's fifteen focal species and activities that can cause human disturbance to shorebirds (of which dog walking was only one; Mengak et al., 2019) throughout online databases such as JSTOR, Science Direct, Google Scholar, Research Gate, and Springer Link. To ensure a complete and thorough search, we implemented backwards and forward reference searching to verify that the review was complete. As the literature was

compiled from various sources, we reviewed, organized, and tagged it in a Mendeley database. Tags are key terms or text labels that are used to identify the contents of an article and group articles of similar topics. We tagged articles based on their study location, the focal species of the study, the season in which the research was conducted, the migration status of the focal species (i.e. migrant or non-migrant), the breeding status of the focal species (i.e. breeding or non-breeding), the study foci (i.e. the main themes of the study such as education, abundance, signage, nest-site selection, etc.), and disturbance types (i.e. walking, driving, boating, etc.).

Observational Study

We observed beach recreationists walking dogs at Indian Wells Beach in East Hampton, NY for two consecutive days in May 2018. Our observations took place at a distance from beach recreationists to ensure that our presence did not influence the observed behaviors. During the observation study, two researchers independently recorded the number of leashed dogs that entered the beach, the number of unleashed dogs that entered the beach, the number of dog walkers that acknowledged signs relating to dog walking (e.g. looked or stopped to read a sign), the number of dog walkers that did not acknowledge signs relating to dog walking (e.g. walked past signs without looking at them or stopping), changes in leashing activity (e.g. a dog walker leashed or unleashed their dog when walking toward or away from people, another dog, or a restricted shorebird area), and other unexpected insights. The researchers also recorded additional details about the dog walkers such as their gender, approximate age, their activity at the beach and the number of other people with them.

Dog Walker Interviews

Two researchers conducted 20 interviews with dog walkers at Indian Wells Beach for two consecutive days following the observational study. The researchers asked participants open-ended questions that addressed: 1) benefits to leashing dogs on beaches; 2) barriers to leashing dogs on beaches; 3) attitudes towards leashing dogs for the protection of shorebirds; 4) behavioral intentions to leash; and 5) social norms about leashing dogs at the beach. As participants answered the questions, the researchers recorded the responses on paper. Later, each researcher transcribed the responses from their interviews and one researcher qualitatively analyzed the responses from all of the interviews to identify themes to inform the on-site survey. The insights from this analysis informed the design of the survey, particularly the response options.

On-site Survey: Construction

The literature review, observational study, and interviews informed the development of the onsite beach recreationist survey. The survey consisted of fourteen items that addressed: 1) past behaviors regarding leashing or not leashing dogs in various scenarios 2) barriers to leashing dogs on beaches; 3) benefits to leashing dogs on beaches; 4) attitudes towards shorebird protection; 5) norms relating to leashing dogs on beaches; 6) preferred channels for information on beach management; 7) sources of trust for information on beach management; and 8) demographics. We

explored these concepts through closed-ended questions, consisting of a 5-point Likert scale, multiple-choice questions, and dichotomous questions. To ensure clarity, subject matter experts from the Atlantic Flyway Shorebird Initiative Human Activities Committee who have experience interacting with beach recreationists reviewed the survey, as well as social scientists who have experience with conducting surveys. After review, we implemented the survey with 17 beach recreationists in New York on the first day. We made minor adjustments to the survey wording and length to adjust for issues that arose during this initial implementation.

On-site Survey: Implementation

The on-site beach recreationists survey took place from July through October 2018 within three states along the Atlantic Flyway: New York (July), Maine (August), and South Carolina (September/October) (Appendix A). Within each state, we selected 2-12 beaches to conduct the on-site surveys within a community (or neighboring communities). We conducted surveys based on the time of day that dogs were allowed at each beach. In general, we surveyed from 6:30 to 10:30AM and from 4 to 8PM. We chose the beaches based on the ecological importance of the site for shorebirds, the level of human disturbance at the site, and the presence of dog walking at the site. The number of beaches in New York was greater than the number of beaches in Maine and South Carolina because the length of each beach in New York was smaller compared to the beaches in Maine and South Carolina.

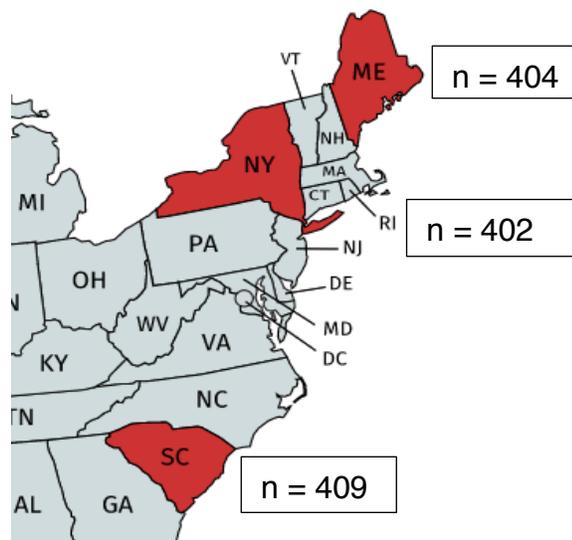


Figure 1. Map of the states (shown in red) included in the study and stars showing the area where the research was conducted in each state with n number of participants per state.

At each site, 1-2 researchers approached beach recreationists with dogs and asked them to participate in a short survey. For just three days in September, 3 researchers conducted surveys. If a beach recreationist had experience dog walking and agreed to participate in the survey, researchers administered the survey using

iPads with a Qualtrics app. In many cases, the surveyor walked with the individual walking their dog while administering the survey. While asking beach recreationists to participate in the survey, researchers recorded the number of individuals who participated and declined, their gender, age, group size, and beach recreation activity.

Survey Analysis

Data were analyzed using SPSS. Participants were separated into two groups of dog walkers: dog walkers who had their dogs leashed (n = 563) and dog walkers who did not have their dogs leashed (n = 498). Although we surveyed people who had experience walking dogs but did not have their dog with them (n = 154), we did not include these individuals in our analysis. For dog walkers who had both leashed and unleashed dogs with them, we considered those dog walkers to be in the group of unleashed dog walkers since those dog walkers generally preferred to have their dogs off leash but needed to leash their dogs for certain reasons such as age or aggression. These dog walkers often noted that they would let their dogs off leash if they felt that their dogs could handle being off leash without getting hurt or hurting another dog. We analyzed differences between the leashed and unleashed dog walker groups using independent t-tests and chi-square tests (Appendix B & C).

Results

Literature Review

During the literature review process, we found 61 articles pertaining to dogs and disturbance to birds, the impacts of dogs on shorebirds, and dog walkers' perceptions of shorebirds. We also evaluated the CBSM literature to derive the meaning of barriers and benefits and found that barriers refer to anything that reduces the probability of engaging in the target behavior while benefits refer to a person's beliefs about the positive outcomes associated with the behavior (Schultz, 2013).

Survey Response

In New York, we surveyed 402 individuals from 12 beaches; in Maine we surveyed 404 individuals from 6 beaches; and in South Carolina we surveyed 409 individuals from 2 beaches. A total 3,621 individuals were approached from 1,948 groups of beach recreationists. Out of those groups, 579 did not have experience walking dogs at the beach, 158 declined to participate, and 1211 participated in the survey. In some cases, more than one individual in a group requested to take the survey ($n = 4$), so there were a total of 1,215 individuals who participated, therefore the adjusted response rate is 88% and the non-response rate is 12%.

Respondent Demographics

There was no statistical difference in the gender distribution of those who had their dogs leashed vs. not leash (Figure 2). There was also no statistical difference between the average age of dog walkers who had their dogs leashed vs. not leashed. The average age of participants who leashed their dogs was 50, and the average age of participants who did not have their dogs leashed was 53 (Figure 3). Age ranged from 18 to 86 for all participants. The distribution of residence type differed among those who leashed their dogs and those who did not. Notably, unleashed dog walkers had a larger proportion of full-time residents and a smaller proportion of vacationers than did leashed dog walkers (Figure 4).

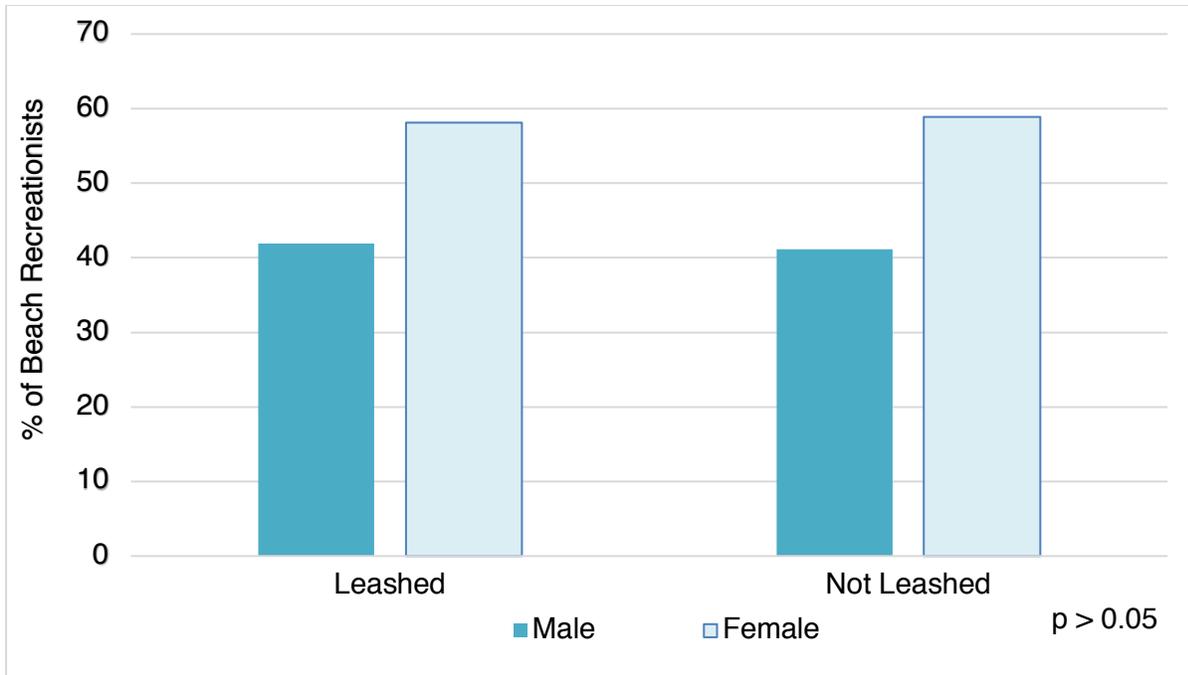


Figure 2. The percent of male and female dog walkers who leashed their dogs and who did not leash their dogs.

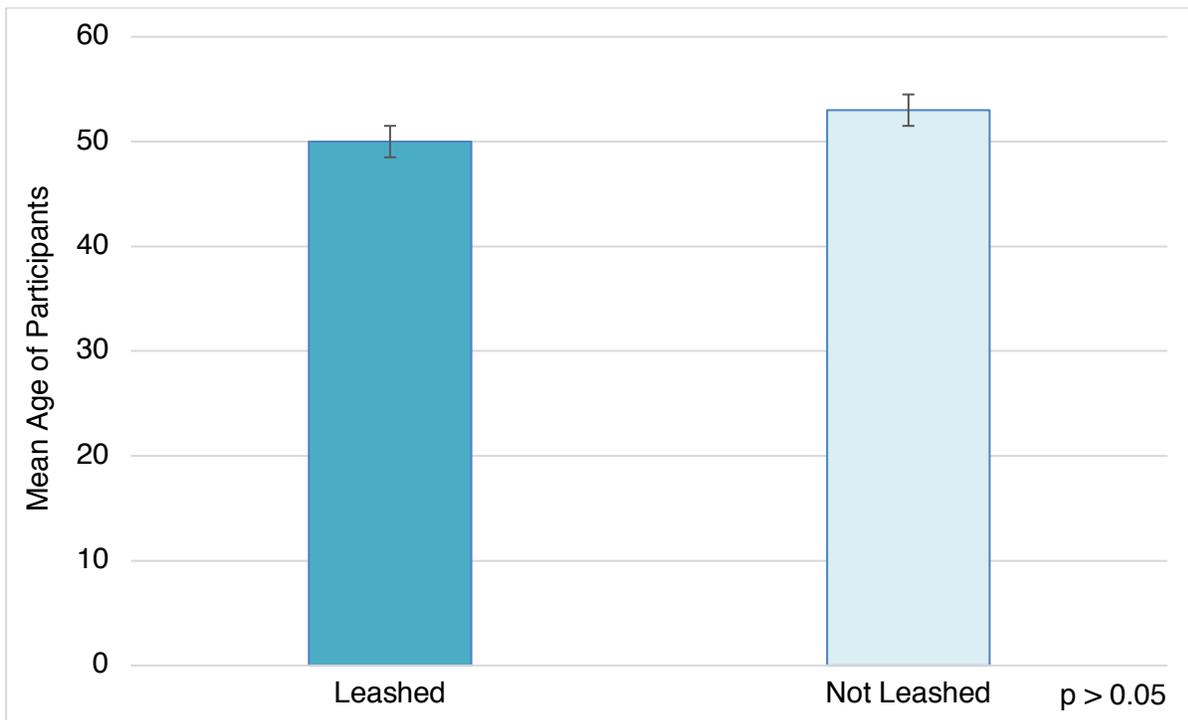


Figure 3. The average age of dog walkers who had their dogs leashed and did not have their dogs leashed.

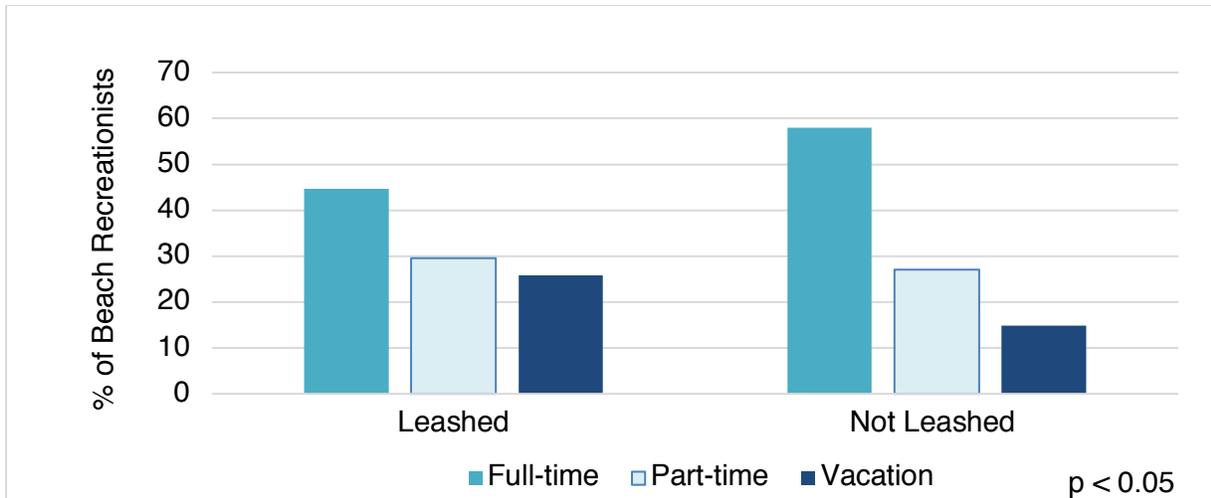


Figure 4. The percent of full-time residents, part-time residents, and vacationers who had their dogs leashed and did not have their dogs leashed.

Leashing Behaviors

When given the choice to let their dogs off-leash, dog walkers who had their dogs off-leash reported on average that they leash their dogs “nearly none of the time” while dog walkers who had their dogs leashed reported on average that they leash their dogs “about 75% of the time” (Figure 5). Despite this difference in leashing behavior, both groups said that they leash their dogs nearly all the time in areas with leash laws and about 75% of time near beach nesting birds (Figure 5).

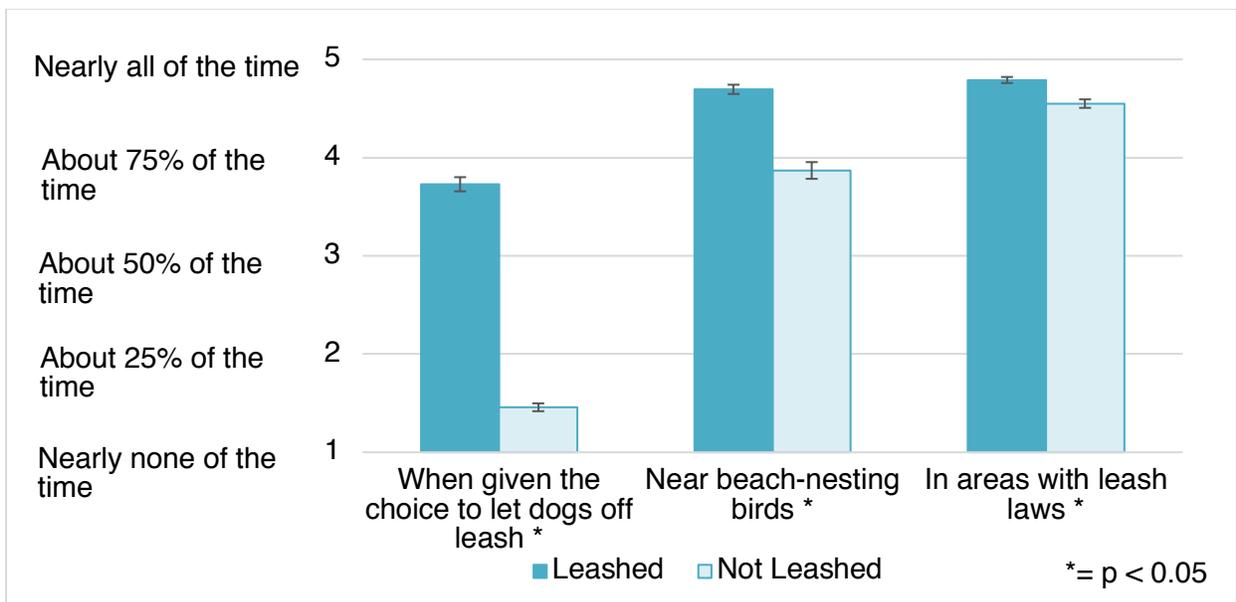


Figure 5. The mean and standard error of the mean for approximate percent of time that leashed dog walkers and non-leashed dog walkers leash their dogs when given the choice to let their dogs off leash, near beach nesting birds, and in areas where there are leash laws.

Barriers and Benefits

We asked participants to rate how strongly they agreed with potential benefits to leashing dogs on the beach (Figure 6). Both groups felt that the top benefits to leashing dogs at the beach were that leashes prevent dogs from running into areas for beach nesting birds; they prevent dogs from bothering other people; they keep dogs safe; and they give owners control over their dogs. Comparing the two groups with t-tests, there was a statistically significant difference ($p < 0.05$) for all of the statements (see Appendix C). Participants who had their dogs leashed agreed more strongly, on average, with all of the statements about the perceived benefits to leashing dogs than the participants who had their dogs off-leash.

We asked participants to rate how strongly they agreed with potential barriers to leashing dogs on the beach (Figure 7). Comparing the two groups' means, there was a statistically significant difference for all of the statements except "my dog pulls on the leash." Dog walkers who had their dogs off-leash agreed, on average, that it is not necessary to leash their dogs because their dogs respond well to their commands, it prevents their dogs from socializing, and it prevents their dogs from exercising. In contrast, the group of dog walkers with their dogs leashed disagreed, on average, with these statements. Both groups disagreed, on average, that leashing makes their dogs feel threatened.

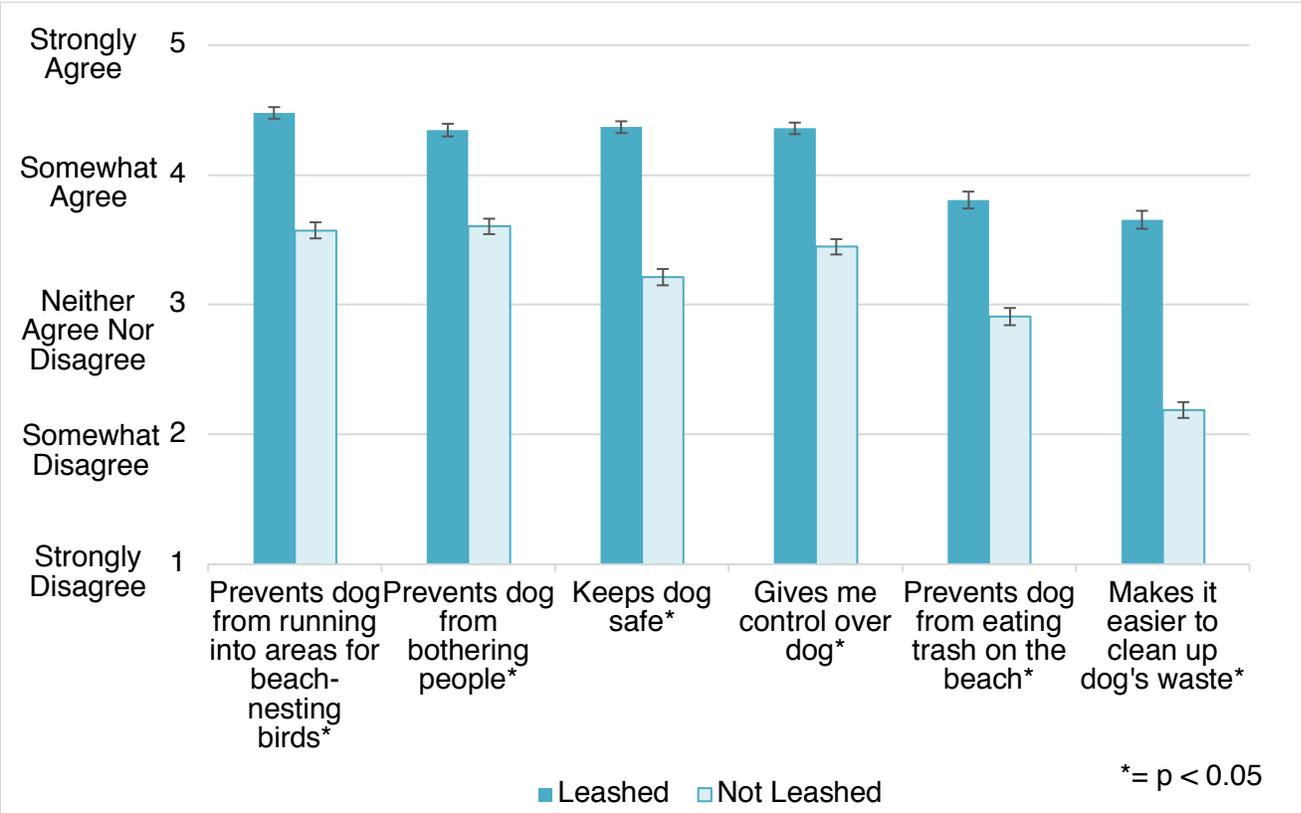


Figure 6. The potential benefits to leashing dogs at the beach for leashed and non-leashed dog walkers.

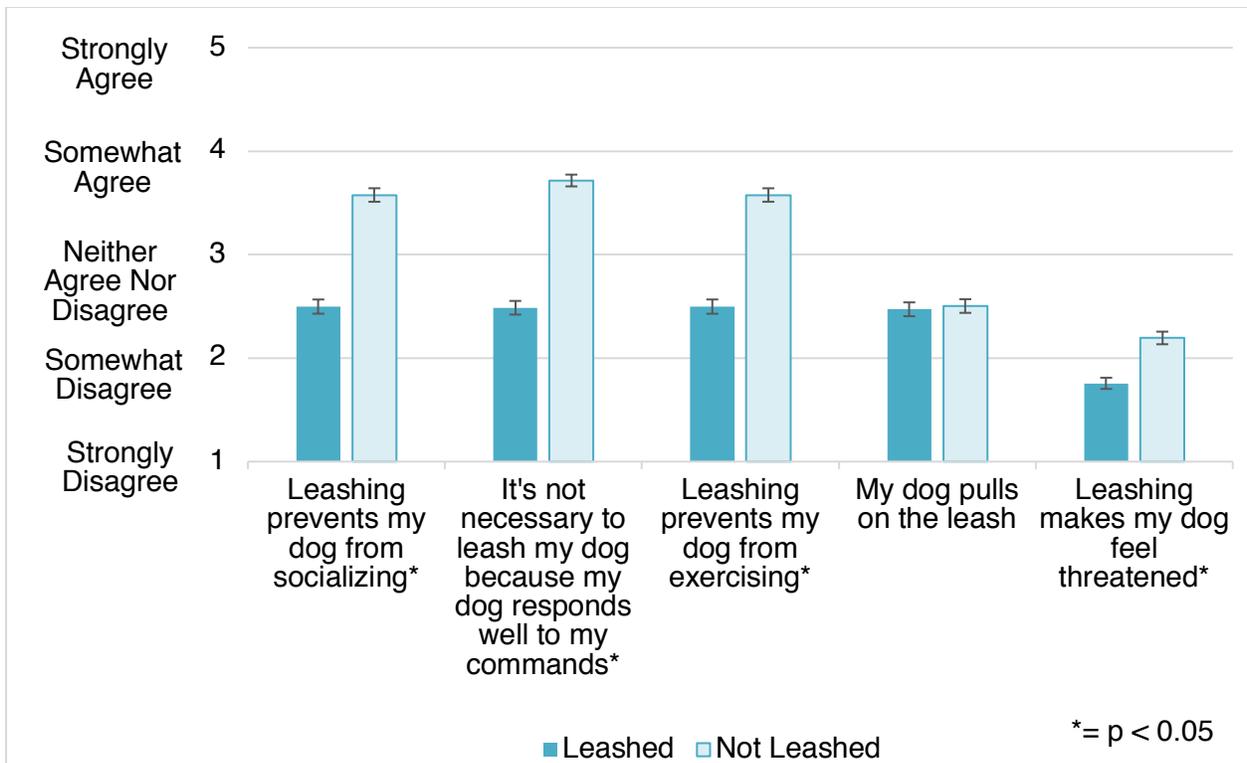


Figure 7. The potential barriers to leashing dogs at the beach for leashed and non-leashed dog walkers.

Norms and Attitudes Towards Leashing Dogs

The social norm (informal rule of behavior that is shared by a group of people) to leash dogs near beach nesting birds was lower for dog walkers who had their dogs off-leash than dog walkers who had their dogs leashed. Dog walkers who had their dogs leashed agreed that their friends and family expected them to leash their dogs near beach nesting birds. Dog walkers with dogs off-leash rated this statement slightly closer to neither agree nor disagree. Additionally, the personal norm (a person’s internal standards about how they should behave) to leash dogs near beach nesting birds was higher for dog walkers who had their dogs leashed. Both groups agreed, on average, that they would feel guilty if I walked my dog off-leash near beach nesting birds (Figure 8).

Yet, dog walkers who had their dogs off-leash disagreed that their dog would pose a threat to beach nesting birds, and dog walkers who had their dogs leashed averaged near neither agree nor disagree about this statement. Still, both groups felt that that dog walking should be controlled for the protection of beach nesting birds. However, participants from both groups also felt that it was important to have unleashed dog access. In particular, the group of dog walkers who had their dogs off-leash was very adamant about this with an average of nearly “strongly agree” for the statement (Figure 9).

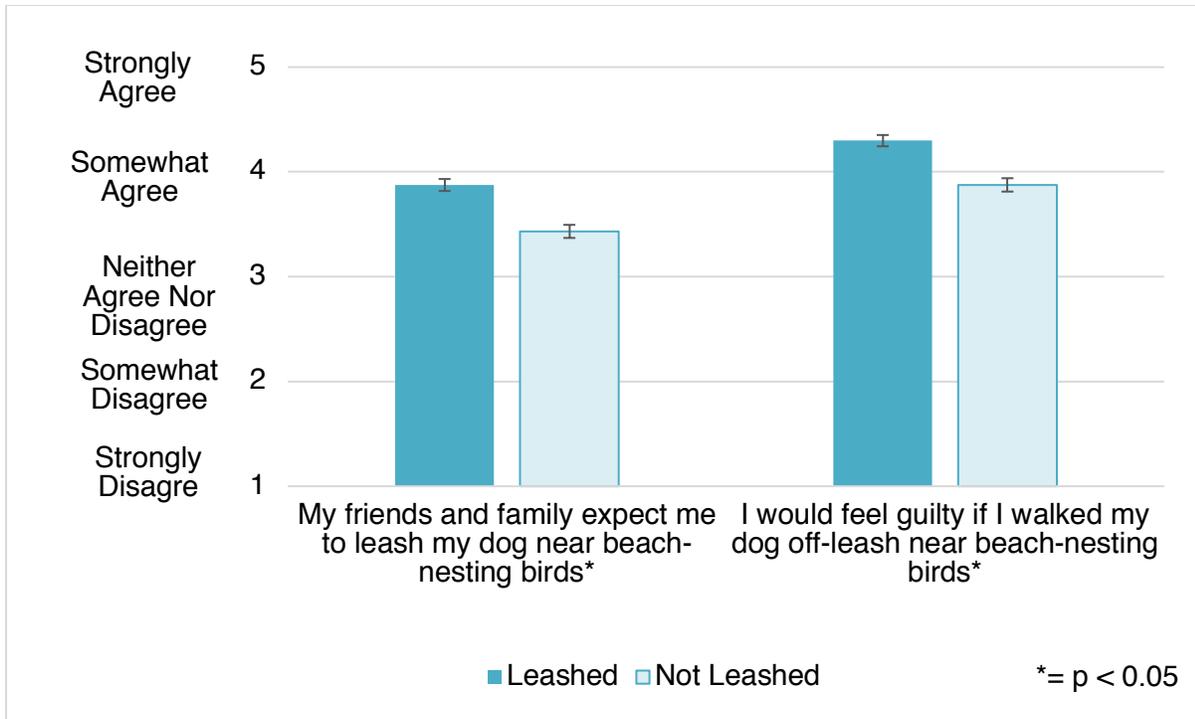


Figure 8. Social and personal norms of leashed and non-leashed dog walkers.

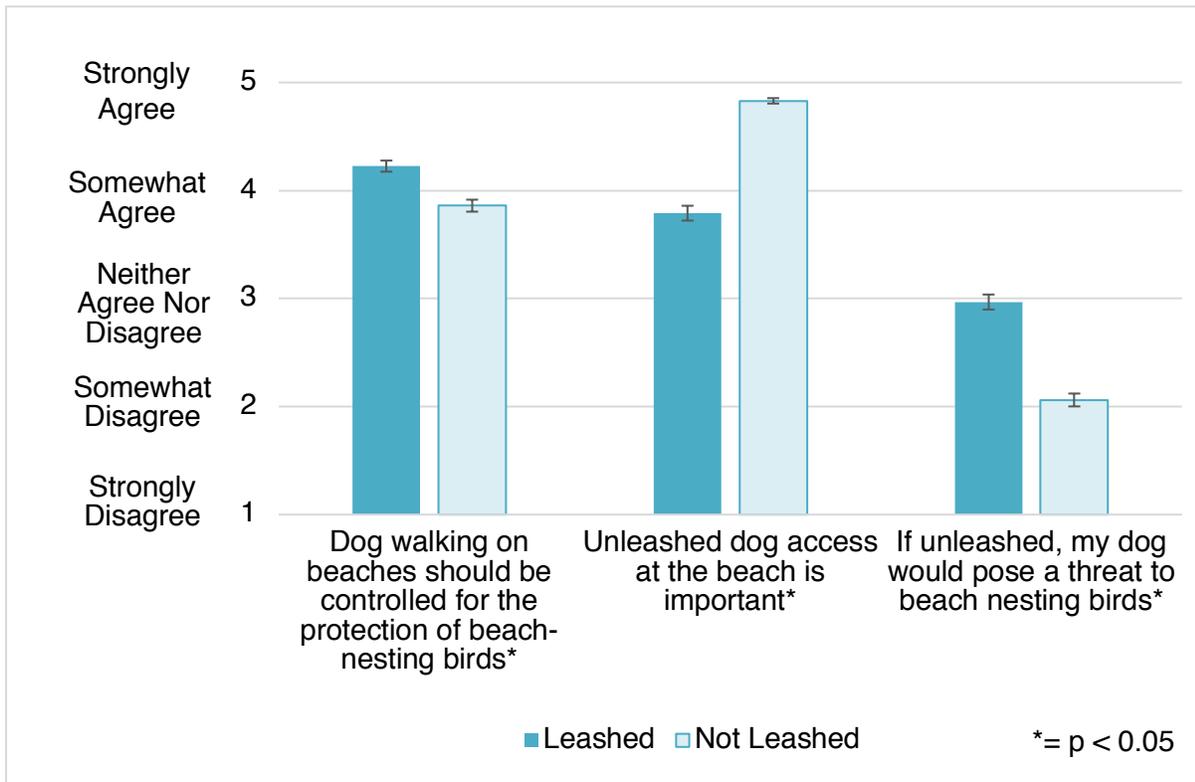


Figure 9. Attitudes about dog walking and beach nesting birds of leashed and non-leashed dog walkers.

Trust of Information Channels

There was no significant difference (for Chi-square analyses with $p < .05$) between the group of dog walkers who leash their dogs and the group of dog walkers who do not leash their dogs when asked about sources that they would trust for information on beach management. Both groups had a strong preference for receiving information from NGOs with over 88% of participants choosing this as a preferred information source. Local governments, wildlife agencies, and local dog clubs were also ranked high with approximately 80% of participants in both groups saying that they would trust these sources. While most sources were trusted, less than 50% of participants agreed that they would trust a pet store for sources of information about beach management (Figure 10).

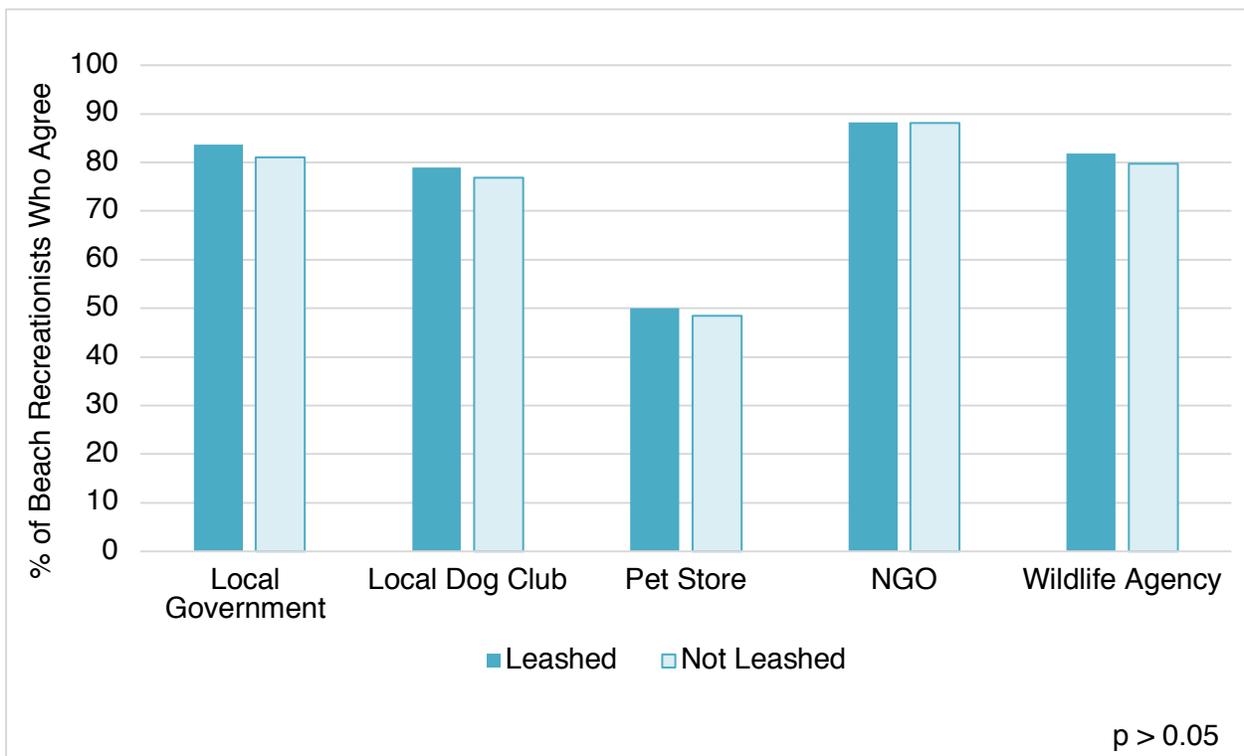


Figure 10. Trust of information channels about beach management among dog walkers who leash and do not leash their dogs.

Preference for Receiving Information about Beach Management

Participants reported they most prefer signs for receiving information about beach management with over 90% of participants in both groups selecting this option. Websites were also highly preferred with over 80% of participants stating that they prefer this method. Newspapers were the only information source where there was a statistically significant difference between the groups. More participants who had their dogs off-leash preferred receiving information from newspapers than participants who had their dogs leashed (Figure 11).

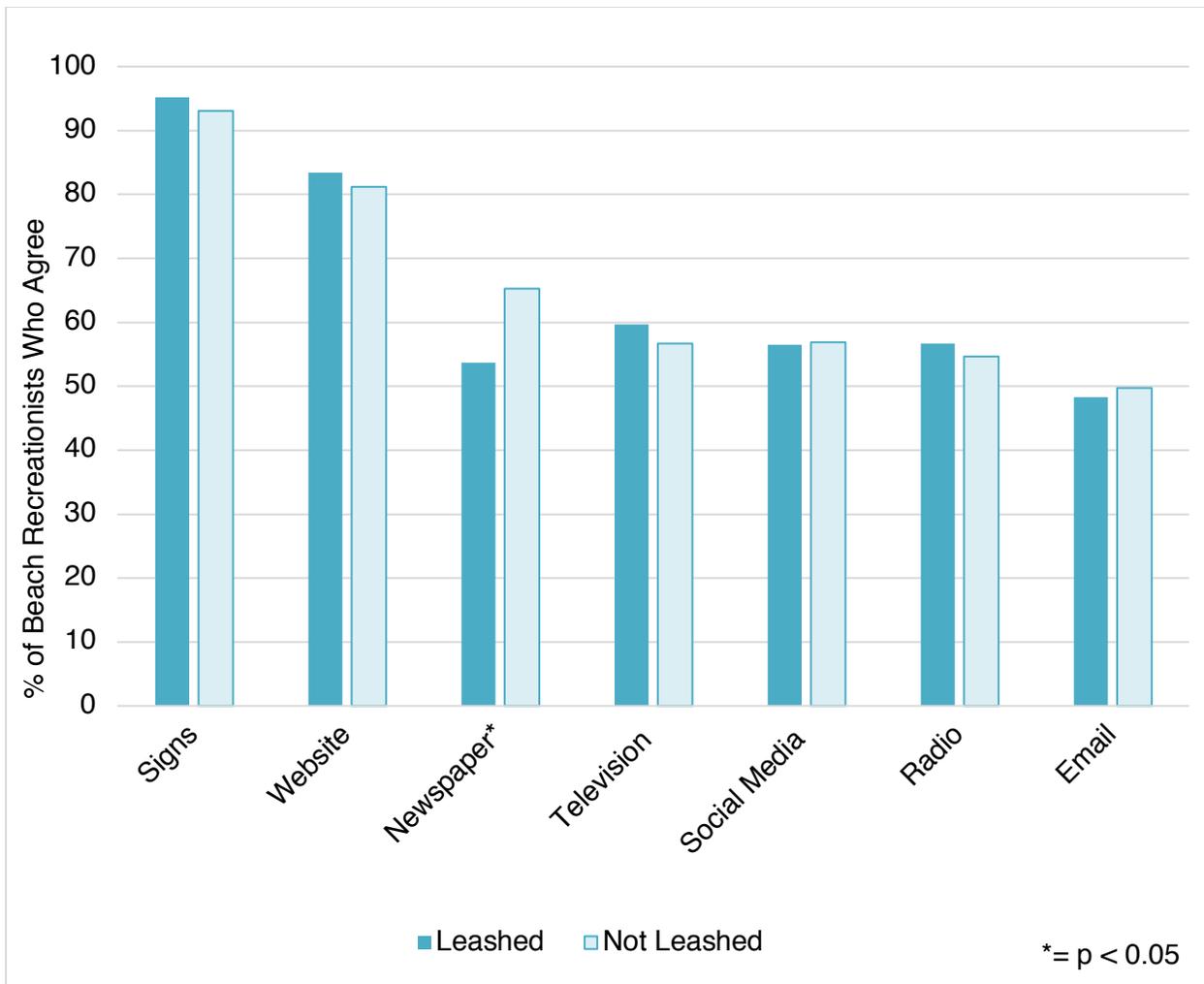


Figure 11. Preference for methods of receiving information on beach management for dog walkers who leash and do not leash their dogs.

Future Directions

Recommendations for CBSM Strategy Development

In developing a pilot campaign, we recommend tools known to maximize benefits and reduce barriers be employed through specific strategies. Below we describe communication, commitment, incentive, norms, and social diffusion tools and provide some suggested strategies. In Table 1, we detail how these tools and strategies align with the most common benefits and barriers identified through this study.

Communication: Communication involves encouraging behavior change by presenting information, making it easy to recall, and showing the impact of the behavior change (McKenzie-Mohr, 2011). This tool can specifically be used to promote behavior change among dog walkers using a variety of techniques. In particular, interpretative signs could be created using persuasive communication and displayed at beach entrances.

Since signs are the preferred communication method for dog walkers, this could be an effective way to encourage behavior change.

When creating interpretive signs there are some key elements that should be incorporated into the design. First, to capture the attention of a viewer, the sign should have a provocative title. Once the viewer is drawn to the sign, it should keep their attention by using attractive imagery, unique and novel elements, and simple language that avoids jargon and frames the message in a positive manner. Through text and imagery, the sign should convey a story that evokes emotion and gets the viewer to reflect on their own beliefs that are relevant to the message. Communications should also capitalize on dog walkers' affinity for receiving information via signs and websites, which have the potential to reach large audiences. Moreover, if messages on signs and websites are conveyed through trusted sources such as wildlife agencies, local governments, and NGOs, then dog walkers may be more inclined to engage in the messages.

Commitment: Commitment is the act of agreeing to a request that often alters the way people view themselves (e.g. a supporter of shorebird conservation). After this change, then committed people will experience internal pressure to act consistently with this new self-perception (i.e. staying out of shorebird nesting areas) (McKenzie-Mohr, 2011). Signing a pledge can be an effective means to secure commitment, encouraging dog walkers to keep their dogs on leash and away from bird nesting areas. The pledge can be signed as dog walkers enter or exit beaches or at alternative locations such as a veterinarian office, a pet store, or a dog adoption center. Pledges could also be signed as people purchase beach parking permits or dog walking permits (where required). Commitment can also be secured and publicly displayed by dog walkers taking a photo with a sign that states "I keep my dog away from nesting areas." An organization coordinating the photo-taking could display the photos on a kiosk near the beach entrance or on social media. The display of the photos would also give the impression that this behavior is the norm (see more under Norms below).

Incentives: Incentives are a form of motivation that promotes behavior; they can be particularly effective when motivation to engage in change is low (McKenzie-Mohr, 2011). Incentives could be offered to people who walk their dogs in alternative areas away from key areas for shorebirds, such as dog-friendly zones on the beach. It could be challenging to determine who to give incentives to since you do not want to hand out rewards to people who are not necessarily changing their behavior. To identify those who are engaging in behavior change, you could initiate a pledge campaign when beaches open for the season or during events that promote dog walking in dog-friendly beach zones. During these events, you can offer incentives such as dog toys, dog treats, watering stations, free beach parking permits, or preferred beach parking passes (i.e. closer to the beach) to people who participate in the pledge.

Norms: Norms are unofficial rules about how a person should act in a particular place. If we know how people think they should act, or how they think other people should act,

then we can use that understanding to our advantage to create behavior change (McKenzie-Mohr, 2011). Given we found that being a responsible dog owner is a social norm that is embraced by dog walkers, this information can guide strategies that capitalize on this norm. As with commitments, dog walkers could take photos with their dogs leashed and have these photos displayed on a kiosk at the beach to show vacationers or people who are not familiar with the social norm that it is the common practice to leash dogs at beaches. Signage at beach entrances can also reflect these messages through pride campaigns, which build momentum for conservation by inspiring enthusiasm about ecologically unique resources within communities and turning those resources (e.g. shorebirds) into a symbol of local pride using grassroots and mass-marketing techniques such (i.e. bumper stickers, school visits, art competitions, talks and lectures to community groups, articles in local papers or magazines; Rare 2007).

The norm to leash dogs near shorebirds could also be displayed (another form of Commitment as described above) by having dog walkers walk their dogs on leashes with T-shirts, buttons, or dog vests that state “This dog shares the shore with shorebirds” or a phrase that expresses the meaning of their action to the public. If a strategy involves social norms, it is imperative that the norm is exhibited to the public at times that are impactful. For instance, if dog walkers are only allowed on beaches in the early morning or late evening, it would be best to target the strategy during these times rather than mid-day, when walkers may not be present.

Social Diffusion: Social diffusion requires trusted sources to share information and spread it among a group or community (McKenzie-Mohr, 2011). To be most effective, trusted individuals need to commit to telling others about the behavior change (e.g., leashing dogs on beaches near shorebirds). If this tool is used, it is important to make sure that the people communicating the behavior change to potential adopters of the behavior are people who have common characteristics with the potential adoptees such as a fellow dog walker, or they should be a respected person in the community, such as a local veterinarian.

Table 1. Tools that can be used to implement strategies that aim to increase the benefits and decrease the barriers of leashing dogs on beaches with shorebirds.

Benefits and Barriers	Recommended Tools	Strategies
<p><i>Benefits</i></p> <p>Leashing prevents my dog from running into areas closed for birds</p>	<p>Communication; Commitment; Incentive</p>	<p>Use interpretive signs or websites to inform dog walkers about ways they can protect shorebird, such as leashing their dogs at the beach. Use a pledge campaign to foster leashing dogs near</p>

		nesting areas as a way to protect shorebirds Provide incentives such as dog toys for people who commit to leashing their dog(s) near nesting areas
Leashing prevents my dog from bothering other people	Commitment; Norms	Encourage people to commit to or display their support for leashing dog(s) as a way to prevent them from bothering people
Leashing keeps my dog safe	Commitment; Social Diffusion	Conduct a pledge campaign to encourage people to leash their dog(s) to keep them safe Encourage dog walkers to share messages with other dog walkers about how leashing keeps dogs safe
Leashing gives me control over my dog	Commitment	Encourage dog walkers to pledge that they will leash their dogs to gain greater control near nesting birds

Barriers

Leashing prevents my dog from socializing	Communication	Use signs or websites to inform dog walkers about places where they can take their dog(s) for socialization.
It's not necessary to leash my dog because s/he responds well to my commands	Norms; Incentives	Provide incentives such as dog treats to leashed dogs at beaches with nesting birds. Shorebird monitors could carry dog treats with them and give them to leashed dog(s) as a way to reward behavior change and reinforce the social norm.

Leashing prevents my dog from getting necessary exercise	Communication	Use interpretive signs or websites to tell dog walkers about other places that they can take their dog(s) for exercise. Suggest dog-friendly beach zones that don't impact shorebirds
--	---------------	---

Next Steps

The information from the benefits and barriers analysis can be used to develop a strategy (CBSM third step) that reduces the barriers and increases the benefits of leashing dogs on beaches. This strategy might include zoning certain portions of beaches for beach recreationists to let their dogs off leash or even entire beaches, which would enable dog walkers to walk their dogs over a large distance without restriction. This is particularly important since over 75% of dog walkers were seen walking with their dogs down the length of the beach as opposed to letting their dogs run free in a small area. Through the creation of these areas, dogs and dog walkers can get exercise at the beach, which they highly value, and shorebirds can be simultaneously protected by preventing dog walkers from taking dogs to more sensitive areas that are valuable for shorebirds. If this strategy is implemented, it would be important to consider the likelihood that people would be willing to take dogs to these areas; if zoned areas are farther from areas that people are accustomed to going, this could introduce a new barrier. Therefore, it would be essential to conduct a benefits and barriers analysis for this new strategy. It is also important to recognize that creating a regulatory zone may not be effective if an agency or organization does not have the staff or capacity to enforce the zone regulations.

Once a strategy is developed, it can be pilot tested (CBSM fourth step) at sites along the Atlantic Coast that are low performing due to the presence of dogs (see Biological report). Further, it would be optimal to pilot multiple strategies to determine the level of involvement required. For example, a strategy could involve 1) zoning and communication only; 2) zoning, communication and social norms; and 3) social norms and communications only. Through this process of combining CBSM tools, the impact could potentially be enhanced, leading to positive behavior change and reduced disturbance to shorebirds. If a pilot phase shows that the strategy to promote leashing dogs on beaches can result in positive behavior change through one of these approaches better than others, then the strategy can be implemented on a larger scale with an evaluation of biological and social results (CBSM fifth step).

Another behavior identified through the land manager survey as being appropriate for the CBSM approach is walking or running around a flock of shorebirds rather than through them. This behavior is rated by land managers as having the greatest likelihood of reducing human disturbance, the most likely behavior to be adopted by beach recreationists, the most applicable to beach recreationists, and a behavior that beach recreationists have already embraced, making adoption of this behavior very likely through CBSM. Therefore, we recommend using the methods for

the benefits and barriers analysis to study this additional behavior and possibly others that could be promoted to reduce human disturbances to shorebirds.

Literature Cited

- Albert, A., & Bulcroft, K. (1987). Pets and Urban Life. *Anthrozoos*, 1(1), 9-25.
- Antonacci, K. (2017, July 17). Dog's owner steps forward in killing of protected Maine bird. Retrieved from: <https://www.centralmaine.com/2013/07/17/dog-and-owner-talking-to-state-about-plover/>
- Atlantic Flyway Shorebird Initiative (AFSI) Business Plan. (2015). Retrieved from: www.atlanticflywayshorebirds.org
- Banks, P.V., & Bryant, J.B. (2007). Four-legged friend or foe? Dog walking displaces native birds from natural areas. *Biology Letters*, 3, 611-613.
- Borneman, T.E., Rose, E.T., & Simons, T.R. (2016). Off-road vehicles affect nesting behaviour and reproductive success of American oystercatchers (*Haematopus palliatus*). *Ibis*, 158, 261-278.
- Burger, J., Carlucci, S. A., Jeitner, C. W., & Niles, L. J. (2007). Habitat choice, disturbance, and management of foraging shorebirds and gulls at a migratory stopover. *Journal of Coastal Research*, 235(235), 1159–1166.
- Burger, J., Gochfeld, M., Jenkins, C. D., & Lesser, F. (2010). Effect of approaching boats on nesting black skimmers: using response distances to establish protective buffer zones. *Journal of Wildlife Management*, 74(1), 102–108.
- Comber, C.A. & Dayer, A.A. (2019). Atlantic Flyway disturbance project social science report: Part I: Land manager survey. Unpublished.
- Flemming, S.P., Chiasson, R.D., Smith, P.C., Austin-Smith, P.J., & Bancroft, R.P. (1988). Piping plover status in Nova Scotia related to its reproductive and behavioral response to human disturbance. *Journal of Field Ornithology*, 59, 321-330.
- Geller, E.S. (1981). Evaluating energy conservation programs: Is verbal report enough? *Journal of Consumer Research*, 8, 331-335.
- Geller, E. S., Erickson, J. B., & Buttram, B. A. (1983). Attempts to promote residential water conservation with educational, behavioral and engineering strategies. *Population and Environment*, 6, 96-112.
- Harmon, L. (2014, June 7). Move over plover: the beach is for people. *Boston Globe*. Retrieved from: <https://www.bostonglobe.com/opinion/2014/06/07/move-over-plover-beach-for-people/zv12SgGZCFwaiMXXi3XnIJ/story.html>

- Jordan, J. R., Hungerford, H. R., & Tomera, A. N. (1986). Effects of two residential environmental workshops on high school students. *Journal of Environmental Education, 18*, 15-22.
- Jorgensen, J.G., & Bomberger Brown, M. (2014). Piping plovers *Charadrius melodus* and dogs: compliance with and attitudes toward a leash law on public beaches at Lake McConaughy, Nebraska, USA. *Wader Study Group Bull, 121*(2): 7–12.
- Jorgensen, J.G., & Bomberger Brown, M. (2015). Evaluating recreationists' awareness and attitudes toward piping plovers *Charadrius melodus* at Lake McConaughy, Nebraska, USA. *Human Dimensions of Wildlife, 20*(4): 367–380.
- Lafferty, K. (2001a). Birds at a Southern California beach: seasonality, habitat use and disturbance by human activity. *Biodiversity and Conservation, 10*(11), 1949–1962.
- Lafferty, K. (2001b). Disturbance to wintering western snowy plovers. *Biological Conservation, 101*, 315-325.
- McGowan, C., & Simons, T. (2006). Effects of human behavior on the incubation behavior of American oystercatchers. *The Wilson Journal of Ornithology, 118*(4), 485-493.
- McKenzie-Mohr, D. (2011). *Fostering sustainable behavior: An introduction to community-based social marketing*. New Society Publishers, Philadelphia.
- Melvin, S.M., Griffin, C.R., & Macivor, L.H. (1991). Recovery strategies for piping plovers in managed coastal landscapes, *Coastal Management, 19*(1), 21-34.
- Melvin, S. M., Hecht, A., & Griffin, C. R. (1994). Piping plover mortalities caused by off-road vehicles on Atlantic Coast beaches. *Wildlife Society Bulletin, 22*(3), 409–414. Retrieved from: http://scholarworks.umass.edu/nrc_faculty_pubs/160
- Mengak, L., A.A. Dayer, R. Longenecker, & C.S. Spiegel. (2019). Guidance and best practices for evaluating and managing human disturbances to migrating shorebirds on coastal lands in the northeastern United States. U.S. Fish and Wildlife Service. Retrieved from: https://www.atlanticflywayshorebirds.org/documents/Guidance_BMP_evaluating_managing_human_disturbance_final_full.pdf

- Midden, C. J., Meter, J. E., Weenig, M. H., & Zieverink, H. J. (1983). Using feedback, reinforcement and information to reduce energy consumption in households: A field-experiment. *Journal of Economic Psychology*, 3, 65-86.
- National Fish and Wildlife Foundation (NFWF). (2018). National Fish and Wildlife Foundation Atlantic Flyway Shorebird Business Plan. Retrieved from: <https://www.nfwf.org/amoy/Documents/afsi-business-plan.pdf>
- Rare. (2007). Rare pride handbook: A guide for inspiring conservation in your community. Arlington, Virginia. Retrieved from: http://www.rareplanet.org/sites/rareplanet.org/files/rare_pride_handbook_english_low_res.pdf
- Roebuck, S. (2017, May 27). Sleeping Bear Dunes officials: Piping plover apparently killed by dog. Retrieved from: <http://upnorthlive.com/news/local/sleeping-bear-dunes-officials-piping-plover-apparently-killed-by-dog>
- Ruhlen, T.D., Abbot, S., Stenzel, L.E., & Page, G.W. (2003). Evidence that human disturbance reduces snowy plover chick survival. *Journal of Field Ornithology*, 74, 300-304.
- Sabine, J.B., Schweitzer, S.H., & Meyers, J.M. (2006). Nest fate and productivity of American oystercatchers, Cumberland Island National Seashore, Georgia. *Waterbirds*, 29, 308-314.
- Sabine, J.B., Meyers, J.M., Moore, C.T., & Schweitzer, S.H. (2008). Effects of human activity on behavior of breeding American oystercatchers, Cumberland Island National Seashore, Georgia, USA. *Waterbirds: The International Journal of Waterbird Biology*, 31(1), 70-82.
- Schulte, S., S. Brown, D. Reynolds, and the American Oystercatcher Working Group (2007). Version 2.0. American Oystercatcher Conservation Action Plan for the United States Atlantic and Gulf Coasts.
- Schultz, P.W. (2013). Strategies for promoting proenvironmental behavior lots of tools but few instructions. *European Psychologist*, 19(2), 107-117.
- Stigner, M. G., Beyer, H. L., Klein, C. J., & Fuller, R. A. (2016). Reconciling recreational use and conservation values in a coastal protected area. *Journal of Applied Ecology*, 53(4), 1206–1214.
- Visser, G. (1986). Verstoring en reacties van overvliegende vogels op de Noordvaarder (*Terschelling*) in samenhang met de omgeving. RIN report 86/17, Texel: 221 pp. Cited in: Smit, C. J., & Visser, G. J. M. (1993). Effects of disturbance on

shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area. *Wader Study Group Bulletin*, 68, 6–19

Weston, M.A., & Elgar M.A. (2007). Responses of incubating hooded plovers (*Thinornis rubricollis*) to disturbance. *Journal of Coastal Research*, 23, 569-576.

Williams, K. J. H., Weston, M. A., Henry, S., & Maguire, G. S. (2009). Birds and Beaches, Dogs and Leashes: Dog Owners’ Sense of Obligation to Leash Dogs on Beaches in Victoria, Australia. *Human Dimensions of Wildlife*, 14(2), 89–101.

Winn, B., Brown, S., Spiegel, C. S., Reynolds, D., & Johnston, S. (2013). *Atlantic flyway shorebird conservation business strategy: A call to action phase 1*. Retrieved from: http://manometcenter.pairserver.com/sites/default/files/publications_and_tools/AtlanticFlywayShorebirdBusinessStrategy.pdf

U.S. Fish and Wildlife Service (USFWS). (1996). Piping plover (*Charadrius melodus*), Atlantic Coast population, revised recovery plan, Hadley, MA.

U.S. Fish and Wildlife Service (USFWS). (2012). Comprehensive conservation strategy for the piping plover (*Charadrius melodus*) in its coastal migration and wintering range in the continental United States. East Lansing, Michigan.

U.S. Fish & Wildlife Service (USFWS). (2014). Endangered and threatened wildlife and plants; threatened species status for the Rufa Red Knot. *Federal Register*, 79(238), 1–64.

Appendix A: Research Site Characteristics

Beach Name	State	Owner	Dog Restrictions	Length of beach (miles)
Louse Point Beach	NY	The Town of East Hampton	From May 15 th through September 15 th dogs are restricted from 10 a.m. - 6 p.m. on all town beaches. Between the hours of 10 a.m. - 6 p.m., on town owned ocean beaches, dogs are permitted 500 feet from a paved road. Dogs traversing the beach through a restricted area must be manually restrained with a leash. Between the	0.50
Maidestone Park Beach	NY	The Town of East Hampton		0.50
Beach Lane	NY	The Town of East Hampton		0.75
Sammy’s Beach	NY	The Town of East Hampton		0.75
Gerard Beach	NY	The Town of East Hampton		0.75

Indian Wells Beach	NY	The Town of East Hampton	hours of 10 a.m. - 6 p.m. on Town-owned bay beaches dogs must be 300 feet in either direction from a paved road end, again they must also be manually restrained when traversing through a restricted area.	0.50
Atlantic Avenue Beach	NY	The Town of East Hampton		1.0
Town Line Beach	NY	The Town of East Hampton		1.0
Napeague Lane	NY	The Town of East Hampton	From September 16 th through May 14 th , restrictions on town beaches are lifted. Dog owner must at all times keep their dogs under control.	1.5
Main Beach	NY	The Village of East Hampton	There are no restrictions during the off-season, however, dogs must always be kept under control and kept out of protected bird nesting areas. Dogs are not permitted on the beach from the second Sunday in May to September 30 of each year from 9 a.m. - 6 p.m. At all other times during this period, dogs must be manually restrained with a leash within areas that are 300 feet of any road end along Atlantic Ocean Beaches. Dogs must always be kept under control and kept out of protected bird nesting areas.	1.0
Wiborg Beach	NY	The Village of East Hampton		0.50
Two Mile Hollow Beach	NY	The Village of East Hampton		0.75
Wells Beach	ME	The Town of Wells	Between April 1 and June 15, dogs are not permitted within the beach areas unless on a leash and under charge of a responsible person. From June 16 through September 15, dogs are not permitted within beach areas between the hours of 8:00 a.m. and 6:00 p.m. From 6:00 p.m. until 8:00 a.m., dogs are permitted within beach areas only when on a leash and under charge of a responsible person. Exceptions: This section does not apply to dogs on the property of their owner or on another property with the owner's permission, to seeing eye dogs or	2.0
Drake's Island	ME	The Town of Wells		1.25

			other dogs assisting an individual with a disability or to working police dogs.	
Gooch's Beach	ME	The Town of Kennebunk	Dogs are permitted all day from Labor Day to June 15 and before 9 a.m. and after 5 p.m. from June 15 to Labor Day. Owners must have their dogs under voice control at all times.	0.50
Parson's Beach	ME	The Town of Kennebunk		0.75
Goose Rock Beach	ME	The Town of Kennebunkport	<p>The West End Plover Protection Area at Goose Rocks Beach ("WEPPA"), which begins at Norwood Avenue and continues westerly to the Batson River, is designated a Limited Dog Access Area.</p> <p>From April 1 to September 30, in the Limited Dog Access Areas, dogs must be on leash at all times, except that from June 15 to September 30 between 8:30 am and 6:00 pm, no dogs are permitted on the beach</p> <p>From April 1 to September 30, no dogs shall approach or remain within 200 feet of any clearly marked Nesting Area, except that lawns or upland properties within 200 feet of a Nesting Area are excluded from this requirement.</p> <p>From April 1 to September 30, dog owners who live within 200 feet of a Nesting Area must leash their dog when attempting to access the beach and stay as far away as possible from the Nesting Area.</p> <p>From April 1 to June 14th, dogs must be on leash on the beach at all times other than between 6:00 am and 7:30 am, when they may be off leash if under voice and sight control.</p> <p>From June 15 to September 30, if under voice and sight control, dogs may be off leash on the beach between 6:00 am and 7:30 am.</p>	2.0

			<p>From June 15 to September 30, dogs are not permitted on the beach between 8:30 am and 6:00 pm. This provision does not apply to use of a service dog by a person with a disability when the dog is required to perform work or tasks directly related to the person's disability. Between 6:00 pm and 6:00 am and between 7:30 am and 8:30 am, dogs are permitted on the beach if on leash. Between 6:00 am and 7:30 am, dogs may be off leash, if under voice and sight control.</p> <p>From October 1 through March 31, if under voice and sight control, dogs may be off leash on the beach, except between 12:00 pm and 2:00 pm when they must remain on leash.</p>	
Old Orchard Beach	ME	The Town of Old Orchard Beach	<p>Dogs must be on a leash or voice command at all times when off the owner's premises.</p> <p>Dogs are not allowed on the beach from 10 a.m. to 5 p.m. from Memorial Day to Labor Day</p>	3.0
Sullivan's Island Beach	SC	The Town of Sullivan's Island	<p>Summer: (May 1st – September 30th) Off leash: 5:00am - 10:00am No Dogs: 10:00am - 6:00pm On Leash: 6:00pm - 5:00am</p> <p>Winter: (October 1st – April 30th) Off Leash: 5:00am - Noon On Leash: Noon - 5:00am</p>	4.0
Isle of Palms Beach	SC	The City of Isle of Palms	<p>Dogs can be off-leash from 5:00 AM until 9:00 AM April 1st - September 14th and 4:00 PM until 10:00 AM September 15th through March 31st. Dog owners must have leash in hand and have their dog under voice command. At all other times, dogs must be on leash and under complete control, even in the water.</p>	7.0

Appendix B: Chi-Square Values of Characteristics, Trusted Sources for Information, and Preferred Information Channels of Dog Walkers

<i>Parameter</i>	<i>Chi-Square Value</i>	<i>p-value</i>
<i>Characteristics of Dog Walkers</i>		
Gender	0.075	0.784
Beach Community Residency	25.03	0.001
<i>Trust on Information Channels about Beach Management</i>		
Local Government	1.237	0.266
Local Dog Club	0.619	0.431
Pet Store	0.249	0.618
NGO	0.003	0.960
Wildlife Agency	0.760	0.383
<i>Preference for Methods of Receiving Information on Beach Management</i>		
Social Media	0.015	0.901
Website	0.896	0.344
Newspaper	14.81	0.001
Signs	1.921	0.166
Email	0.219	0.640
Radio	0.410	0.522
Television	0.966	0.326

Appendix C: Independent Sample T-test of Benefits and Barriers to Leashing Dogs, Norms, Attitudes, and Leashing Behaviors of Dog Walkers

<i>Parameter</i>	<i>Mean: Leash</i>	<i>Mean: No Leash</i>	<i>p-value</i>
<i>Benefits to Leashing Dogs</i>			
Prevents dog from running into areas for beach nesting birds*	4.4778	3.5732	<0.001
Prevents dog from bothering people*	4.3454	3.6036	<0.001
Keeps dog safe*	4.3682	3.2125	<0.001
Gives me control over my dog*	4.3589	3.4464	<0.001
Prevents dog from eating trash on the beach*	3.8068	2.9088	<0.001
Makes it easier to clean up dog's waste*	3.6545	2.1889	<0.001
<i>Barriers to Leashing Dogs</i>			
Leashing prevents my dog from socializing*	2.3655	3.4050	<0.001
It's not necessary to leash my dog because my dog responds well to my commands*	2.4869	3.7166	<0.001
Leashing prevents my dog from exercising*	2.4980	3.5765	<0.001
My dog pulls on the leash	2.4719	2.5036	0.737
Leashing makes my dog feel threatened*	1.7565	2.1950	<0.001
<i>Norms</i>			
My friends and family expect me to leash my dog near beach nesting birds*	3.8753	3.4325	<0.001
I would feel guilty if I walked my dog off-leash near beach nesting birds*	4.2984	3.8761	<0.001
<i>Attitudes</i>			
Dog walking on beaches should be controlled for the protection of beach nesting birds*	4.2258	3.8597	<0.001
Unleashed dog access at the beach is important*	3.7903	4.8301	<0.001
If unleashed, my dog would pose a threat to beach nesting birds*	2.9677	2.0610	<0.001
<i>Leashing Behaviors</i>			
When given the choice to let dogs off leash *			
Near beach nesting birds *	3.7284	1.4583	<0.001
In areas with leash laws *	4.6944	3.8687	<0.001
	4.7895	4.5493	<0.001

Appendix D: Dog Walking Interview Script

Virginia Tech is conducting a study to learn about dog walking on beaches. We are specifically interested in learning your thoughts and experiences related to dog walking on beaches, as well as keeping dogs on or off leash on beaches. With the information from this interview, we will create a survey to administer to beach recreationists that will aim to explore this topic with a larger group of beach recreationists this summer. The interview and survey will be used to inform a report provided to organizations that work with beach recreationists, as well as [my/a] Masters thesis and a scientific journal article. It is important to keep in mind that there are no right or wrong answers so feel free to openly express your thoughts. Your responses to our questions will never be associated with your name and will be kept confidential. In addition to being confidential, your participation is completely voluntary so you may stop participating in the interview at any time.

1. First, I would like to ask if you consent to continue participating in this interview?
2. Do you have experience with walking a dog on the beach?
3. We would like to find out what you think should be the goals of beach management?
 - a. Prompt: Do you feel that beaches should be managed to maximize recreation experiences? Wildlife conservation? Local jobs?
4. Can you tell us to what extent/how often you leash your dog(s) at the beach when you have the choice?
5. Focusing on your experience, why do you (or do you not) leash your dog(s) at the beach when you have the choice?
 - b. Sub-question: Do you feel there are any benefits or rewards to (not) leashing your dog(s)?
 - c. Sub-question: Are there any challenges or difficulty, if any, to leashing your dog(s) at the beach?
6. Now we are interested in your thoughts on whether or not other people should leash dogs on beaches when they have the choice. Leash or not and why?
 - d. Prompt: Are there any exceptions? Times of year? Situations?
7. While you are at the beach, how often do you see other people leashing their dogs?
8. If other people have their dogs off leash, are you more inclined to let your dog(s) off leash or keep your dog(s) leashed?

- e. Are there other situations when you are more likely than usual to leash your dog(s)?
9. Is there any sort of information that would lead you to change your thoughts about whether dogs should be leashed on beaches when their owners have a choice?
- f. Prompt: Information about the impacts of walking dogs off-leash on the environment? on wildlife?
 - g. Prompt: Information about the impacts of walking dogs off-leash on human health?
10. How likely would you be to leash your dog(s) at the beach, if you were provided with a leash? If you were provided with leash-free areas on the beach or nearby parks?
11. Any other thoughts you want to share about leashing dogs on beaches?

**Would you like more information
about the collaborators and
funders?**

**Dayer Human Dimensions Lab
www.dayer.fishwild.vt.edu/**

**Virginia Tech Shorebird Program
www.vtshorebirds.fishwild.vt.edu**

**National Audubon Society
www.audubon.org**

**National Fish and Wildlife Foundation
www.nfwf.org**