

# Atlantic Flyway Disturbance Project



• Social Science Report •  
*Part I: Land Manager Survey*

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# **Executive Summary**

## ***Background***

According to Atlantic Flyway Shorebird Initiative, human disturbance is one of the most significant threats to shorebird populations. However, there is little information about managers' efforts to reduce disturbances along the Atlantic Flyway. As a result of the variation in site priorities and geography, human disturbance management varies considerably from one site to another. Thus, the state of human disturbance management and monitoring is unknown. Moreover, the effectiveness of common practices to reduce disturbances and the resource needs of managers are not clear due to a lack of empirical data and contradicting conclusions from research studies. Therefore, through a survey to land managers along the U.S. and Canada portions of the Atlantic Flyway, this research aims to create a Flyway wide understanding of these issues and provide organizations and agencies with the information needed to effectively support human disturbance management efforts.

## ***Methods***

Across the Atlantic coast of North America (Atlantic Canada to southern Florida), 201 federal, state, provincial, municipal, and NGO land managers were selected to participate in an online survey. Land managers were selected from sites that are designated as globally Important Bird Areas (IBA) that contain red knots, piping plovers, or American oystercatchers. From August through December 2018, the selected participants were contacted via email and provided with a link to take the survey. Land managers who managed sites within more than four IBAs, were invited to take the survey via phone to expedite completion.

The survey was designed to explore managers' perceptions of the greatest threats to shorebirds at their sites, the current practices and techniques that land managers use to identify, measure, and manage potential human disturbances to breeding and non-breeding shorebirds, managers' perceptions of public response to management practices, the resource needs of managers to protect breeding and non-breeding shorebirds from human disturbance, and managers' perceptions of conservation behaviors that could reduce human disturbances and inform a community based social marketing campaign.

## ***Results***

Human disturbance was rated by managers as the greatest threat to shorebirds along the Atlantic Flyway. Human disturbance is monitored and managed at a majority of sites during the breeding season, but less frequently during the migration and winter seasons. Disturbance is monitored by recording incidental observations and using systematic protocols such as ones that are specific to agencies or organizations. It is also managed through implementing full or partial beach closures from April through August. Closures are communicated to the public using signs, fencing, education/outreach, and law enforcement. In general, managers feel that fencing and signage are the most effective tools to reduce human disturbances, followed by having staff and volunteers conduct informal outreach.



Managers also implement seasonal restrictions on potential human disturbance activities. The most commonly restricted activities are unleashed dog walking, leashed dog walking, and beach driving. Managers noted that leashed dog walking and unleashed dog walking are activities that have the least compliance. When managers encounter issues relating to human disturbances while monitoring, they noted that it is sometimes difficult to get law enforcement to respond because law enforcement is limited and spread thin. Therefore, managers feel that the greatest resource needs are more volunteers and staff, such as law enforcement and outreach personnel to communicate messages about shorebird conservation. When communicating messages about reducing disturbance, messages should focus on promoting behavior changes such as voluntarily leashing dogs on beaches near shorebirds and walking and/or running around shorebird flocks since these behaviors are likely to be embraced by beach recreationists and can have a positive impact on shorebirds.

### ***Future Directions***

The land manager survey can function as a tool to inform organizations and agencies about the state of human disturbance management and monitoring along the Atlantic Flyway. It provides a clear understanding of the efforts perceived to be most effective that might benefit from more funding and application (i.e., fencing and signage) as well as areas where management and monitoring are lacking (i.e., during the migration season) and the greatest resource needs of managers (i.e., more staff). With this information, organizations and agencies can make more informed decisions about where to invest time and effort, how to better prepare for human disturbances, and what tools are likely used most effectively to reduce disturbances.

The survey also informed a community based social marketing effort, identifying potential behaviors that could be promoted to reduce human disturbances. Based on land managers' expert opinion, three behaviors of beach recreationists stood out as having the greatest potential for behavior change campaigns: walking or running around a flock of shorebirds rather than through them; leashing dogs on the beach; and riding bikes around a flock of shorebirds rather than through them. Since the beach recreationists' perceived barriers and benefits to these conservation behaviors are unknown, the next step is to investigate them through interviews, observations, and surveys, as we described for dog leashing in Comber & Dayer (2019). Then a strategy can be developed to promote these behaviors and reduce human disturbances.

## **Introduction**

Human recreational activities on beaches can negatively impact breeding shorebirds by flushing them from their nests and prompting temporary abandonment of eggs and chicks (Verhust et al., 2001; Baudains & Lloyd, 2007). Over time, this can leave them vulnerable to trampling (McGowan & Simmons, 2006), predation (Lafferty 2001), and heat stress (Sabine et al., 2006), which can reduce nest and chick survival over time (Flemming et al., 1988; Strauss, 1990; Dowling & Weston, 1999). Human recreational activities can also exclude migrating and wintering shorebirds from

otherwise high-quality habitats by flushing flocks (Burger & Niles, 2014). Shorebirds evading perceived threats may also expend more energy and forage at decreased rates, which can impact their ability to gain fat reserves necessary for migration (Tarr et al., 2010).

In response to these threats and to the alarming decline of several shorebird species (Thomas, Lanctot, & Székely, 2006), coastal land managers have established guidelines to mitigate human disturbances for some shorebird species. For example, at Cape Hatteras National Seashore, a management, monitoring, and protection plan for piping plovers and American oystercatchers outlines three options of varying management levels to reduce human disturbance from vehicles, boats, and pedestrians (Cohen et al., 2010). Similarly, *The Atlantic Coast Piping Plover Recovery Plan* outlines general guidelines for managing recreational activities in piping plover breeding habitats along the Atlantic Coast. The plan provides specific details on fencing, delineating buffer zones, and restricting activities near nesting areas (United States Fish and Wildlife Service, 1996).

Implementing management techniques to reduce human disturbances can play a critical role in the successful recovery of shorebirds (Hecht & Melvin, 2009). However, ecological conditions can vary among and within sites, which may lead to situations where land managers have to deviate from recommended guidelines (Cohen et al., 2010; United States Fish and Wildlife Service, 1996). Further, diverse land use priorities may limit feasibility of shorebird management recommendations. Since many land managers have the dual mission of promoting recreation and preserving wildlife (Lafferty et al., 2006), some sites may have less restrictive measures to reduce human disturbances than others. Given these site-level realities, it is unclear to what extent human disturbance is managed and monitored along the Atlantic Flyway.

Moreover, it is unclear as to how effective human disturbance management techniques are at reducing negative impacts to shorebirds. For example, several researchers suggest that fencing or closing parts of beaches to reduce disturbances can provide shorebirds with undisturbed areas to forage, roost, and breed (Lafferty, Goodman, & Sandoval, 2006; Ikuta & Blumstein, 2003; Burger & Niles 2014; Schlacher et al., 2013). Yet, other studies have suggested that symbolic fencing alone may not be sufficient to reduce disturbance (Lafferty et al. 2006). Despite the use of symbolic fencing and signs to close certain areas, people still enter them (Forys et al., 2016).

Education and outreach campaigns have also been shown to have varying levels of effectiveness at reducing human disturbance to shorebirds. For example, in Australia, the reproductive success of hooded plovers was attributed to the management regime, which included various forms of media coverage and educational activities (Dowling & Weston, 1999). However, other studies have suggested that education and outreach strategies are minimally effective (Jorgerson & Brown Bomberger, 2014). For example, at Fort Desoto State Park in Pinellas County, Florida, education via signs, web sites, and print media only resulted in an 11% increase in knowledge about shorebird conservation (Ormsby & Forys, 2010).

For conservation practices to be effective, decision-makers need to know what actions do and do not work, or how effective a given action has been in achieving

objectives (Pullin & Knight, 2001). This can be a challenge in situations where there is a lack of published empirical data. However, information gaps in the literature can be reduced by better understanding the experiences and perspectives of land managers, harnessing their expert opinion (Aipanjiguly et al., 2003; Martin et al., 2005; Halpern et al., 2007).

While not intended to replace empirical biological research, expert knowledge is a valuable tool in guiding and expediting the recovery of imperiled species because it can be obtained relatively quickly and with little resources (Donlan et al., 2010). This is particularly important in the evaluation of human disturbance of shorebirds along the Atlantic Flyway because the Atlantic Flyway is a vast network of diverse habitats, spanning several thousands of miles. As such, an empirical assessment of each location along the Atlantic Flyway would be a time-consuming effort that is not practical due to the urgent need for immediate conservation action (Reynolds, 2014). Thus, this research will compile information about current practices and techniques to identify, measure, and manage human disturbances to breeding and non-breeding shorebirds through a survey to land managers across the United States and Canadian portions of the Atlantic Flyway. It will also use expert opinion to determine perceptions of the effectiveness of management practices aimed at reducing shorebird human disturbance, the resource needs of managers to continue promoting shorebird conservation, and managers' perceptions of conservation behaviors that could reduce human disturbances.

#### *Research Questions:*

1. Do managers consider human disturbance to be a priority vis a vis other threats to shorebirds?
2. What are common practices and techniques to identify, measure, and manage human disturbances to breeding and non-breeding shorebirds?
3. How do managers perceive public response to human disturbance management practices and techniques?
4. What do managers need in order to protect breeding and non-breeding shorebirds from human disturbance?
5. What conservation behaviors do managers believe recreationists can be encouraged to do in an effort to reduce human disturbances to shorebirds?

## **Methods**

### ***Survey Sampling Frame***

The survey sampling frame included federal, state, provincial, municipal, and NGO land managers along the Atlantic Flyway, ranging from Atlantic Canada to southern Florida. Land managers across the Atlantic Flyway were chosen from sites that are designated as globally Important Bird Areas (IBA). IBAs are locations that are deemed by Bird Life International as critical areas for the conservation of various bird species around the world ("Bird Life International," n.d.). These areas are often broad

regions that transcend political boundaries. Thus, a variety of land managers oversee different sites within the IBAs. Along the United States portion of the Atlantic Flyway, there are 169 coastal locations with this designation that contain piping plovers (*Charadrius melodus*), red knots (*Calidris canutus*), and/or American Oystercatchers (*Haematopus palliatus*) (“National Audubon Society,” n.d.). Along the Atlantic Canada portion of the Atlantic Flyway, there are 55 coastal IBAs with global, state, or continental priority that contain these species (“IBA Canada Important Bird Areas,” n.d.).

Using information from the IBA co-partner websites, we created a list of these IBAs and the organizations/agencies that own shorebird habitat within each IBA. After creating this list, we searched organization/agency websites to identify employees who would be most knowledgeable about shorebird management for each listed organization/agency. In cases where we were unable to identify the best contact person, we sent the list to shorebird state coordinators and Audubon coastal bird coordinators and asked for their assistance in identifying the correct contact for those missing organizations or agencies. We also asked them to verify that the list of contacts was accurate and complete.

Because some IBAs are not managed for shorebirds and/or contacts could not be identified, 8 of the 169 coastal IBAs in the United States and 6 of the 55 coastal IBAs in Atlantic Canada were not included in this study. Within our database there were 56 land managers responsible for lands within 2 or more IBAs. To reduce respondent burden, we randomly selected which site(s) we would ask managers of more than one site to reference for their responses. Sites were randomly selected with a random digit generator. For managers of 2-3 IBAs, only 1 site was selected; for managers of 4-6 IBAs, 2 sites were selected; for managers of seven or more IBAs, 3 sites were selected. Due to this method of random selection, 21 of 55 IBAs in Atlantic Canada and 96 of 169 IBAs in the United States were represented in the sample database for survey invitations. Since some IBAs have multiple jurisdictions, more than one manager was contacted for 69 IBAs. Thus, the respondents were asked to refer to their management unit within an IBA, rather than to an entire IBA region.

### **Survey Construction**

The survey measured the current practices and techniques that land managers use to manage potential human disturbances to breeding and non-breeding shorebirds, managers’ perceptions of public response to management practices, what is needed by land managers to protect breeding and non-breeding shorebirds from human disturbances, and managers’ perceptions of conservation behaviors that could reduce human disturbances and inform a community based social marketing campaign.

These topics were measured through an online survey consisting of 23 questions that took approximately 20-45 minutes to complete. Survey questions varied in format (see Appendix A). They were primarily close-ended; in some cases, if the answer choices provided were not relevant to a participant, the participants had the option to select “other,” which allowed for text entry. To ensure that the questions and response options resonated with land managers, land manager data from the Northeast Refuges Human Disturbance project, collected by Mengak and Dayer in Fall 2017, were qualitatively analyzed and used to develop the survey. Additionally, the list of human

activities referenced in the survey was identified through a facilitated process with land managers and shorebird scientist to ensure that the survey addressed the potential human disturbances commonly seen across the Atlantic Flyway (Mengak, Dayer, Longenecker & Spiegel, 2019). After drafting the survey, it was pilot tested by five individuals with experience managing shorebirds but who were not part of the sampling frame. It was also reviewed by the Atlantic Flyway Shorebird Human Activities Committee and members of the Virginia Tech Shorebird Program.

### ***Survey Implementation***

The land manager survey was implemented from August – December 2018. Participants who did not respond to the survey received up to two follow up emails and a phone call reminder. To participate, respondents who managed 1-3 IBAs were contacted by email and provided with a link to take an online survey about one of their sites (see above) using Qualtrics online survey platform (Qualtrics, Provo, UT).

Land managers who managed 4 or more IBAs ( $n = 16$ ), were invited through the email to take the survey via phone since they had to answer for 2 or more IBAs. For managers who choose to take the survey via phone, a phone survey was scheduled, and the survey was administered verbally as the respondent visually followed the survey online. This approach reduced respondent burden, allowing land managers to take the survey once and note to the researcher which items required a different response for certain sites. The researcher then input one survey for each of these sites.

### ***Survey Analysis***

Data were analyzed for descriptive statistics using SPSS. The results are presented with “site” as the unit of analysis, except for the land manager characterization which we present with “land manager” as the unit of analysis (thus, only counting managers who had more than one site once for these results).

## **Results**

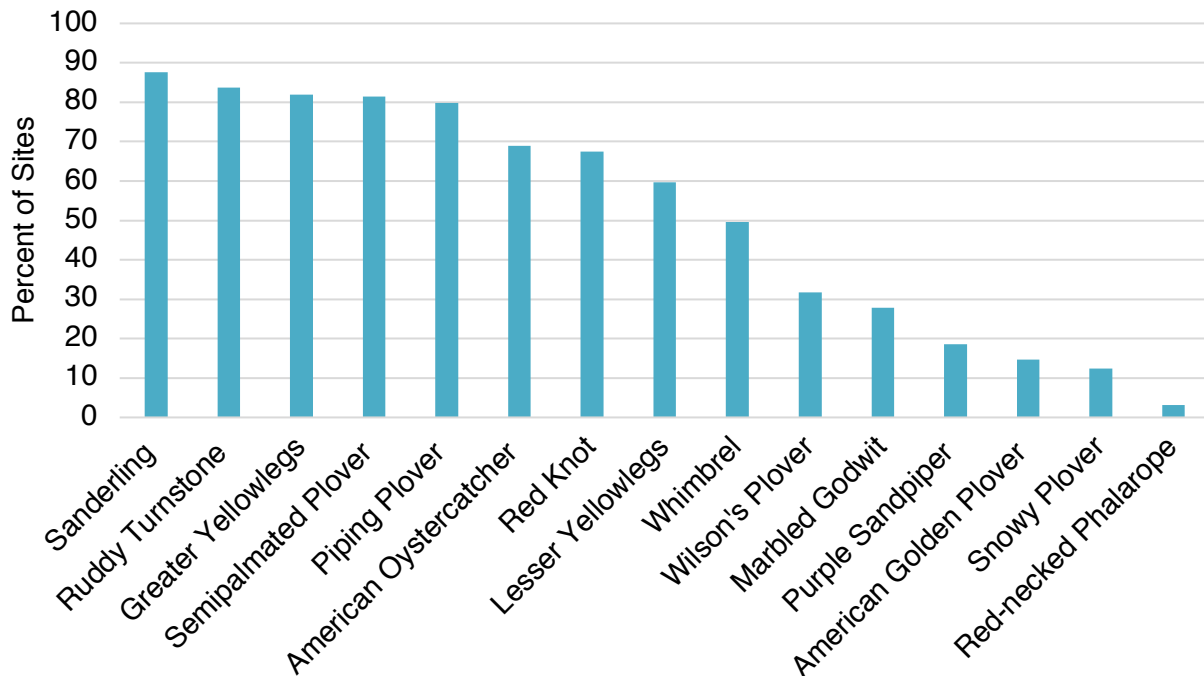
### ***Survey Response***

A total of 194 individuals were contacted for the survey during the recruitment email. After contacting the individuals, 25 people notified us that they were not the appropriate contacts for the survey, that some of the contacted individuals were not available due to work leave or travel; this group was considered “ineligible”. Subsequently, some of these individuals put us in touch with alternative contacts who were better suited to take the survey. In some cases, the alternative contact was an individual who was already contacted to take the survey for another IBA(s) ( $n=3$ ), and thus, we did not ask these individuals to take the survey again. But we did email the survey to the alternative contacts who were not in the original database ( $n=7$ ), bringing the total number of survey participants to 201. From the sample, 112 people took the survey, 58 did not respond and 5 opted out of the survey, making the survey response rate 64%.

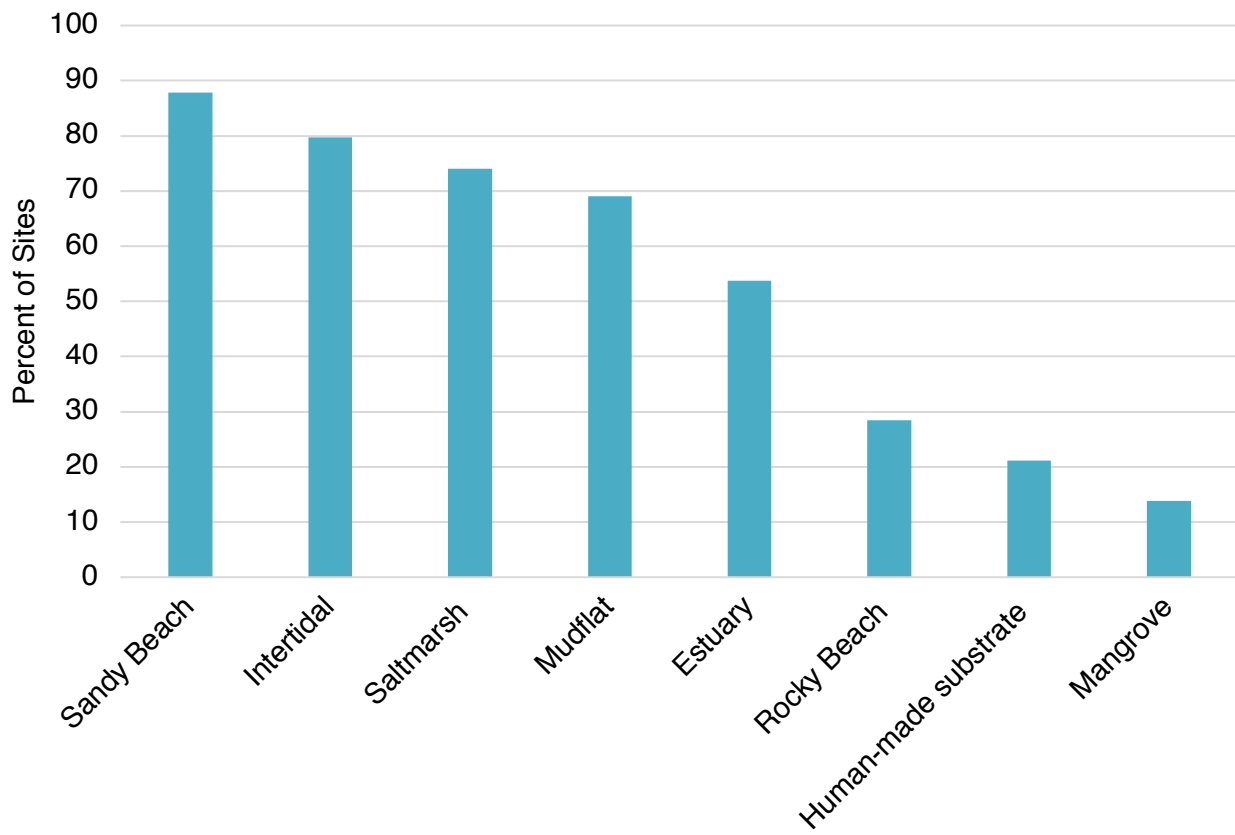


### **Survey Site Characteristics**

Over 60% of the surveyed sites reported having at least one of eight focal shorebird species on an annual basis (Figure 1). In particular, over 65% have the federally threatened red knot, and over 80% have the federally threatened piping plover. The sites were most commonly characterized as sandy beach habitats, followed by intertidal, saltmarsh, mudflat, and estuary habitats. Less commonly occurring habitats include rocky beach, human-made substrate, and mangrove (Figure 2).



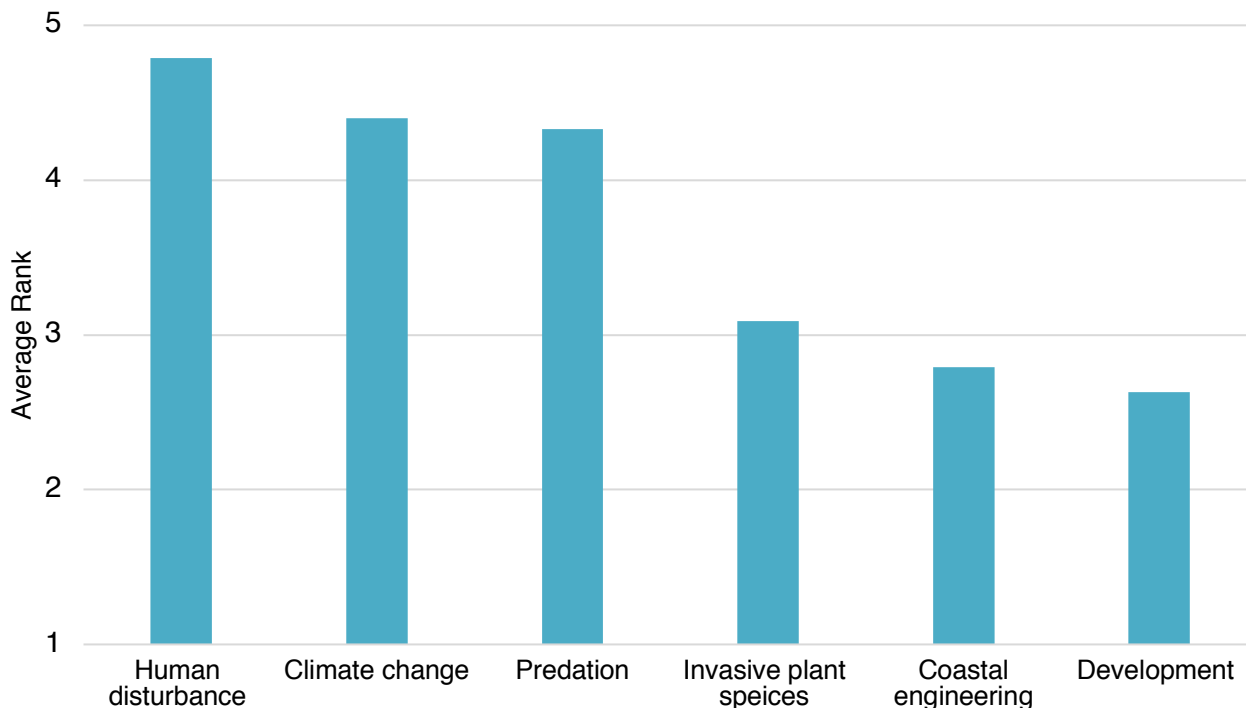
**Figure 1.** The percent of surveyed sites along the Atlantic Flyway with shorebirds that are considered focal species by the AFSI and are present at sites on an annual basis at some point during the year.



**Figure 2.** The percent of sites surveyed that have sandy beach, intertidal, saltmarsh, mudflat, estuary, rocky beach, human-made substrate, and mangrove habitats.

### ***Greatest Threats to Shorebirds***

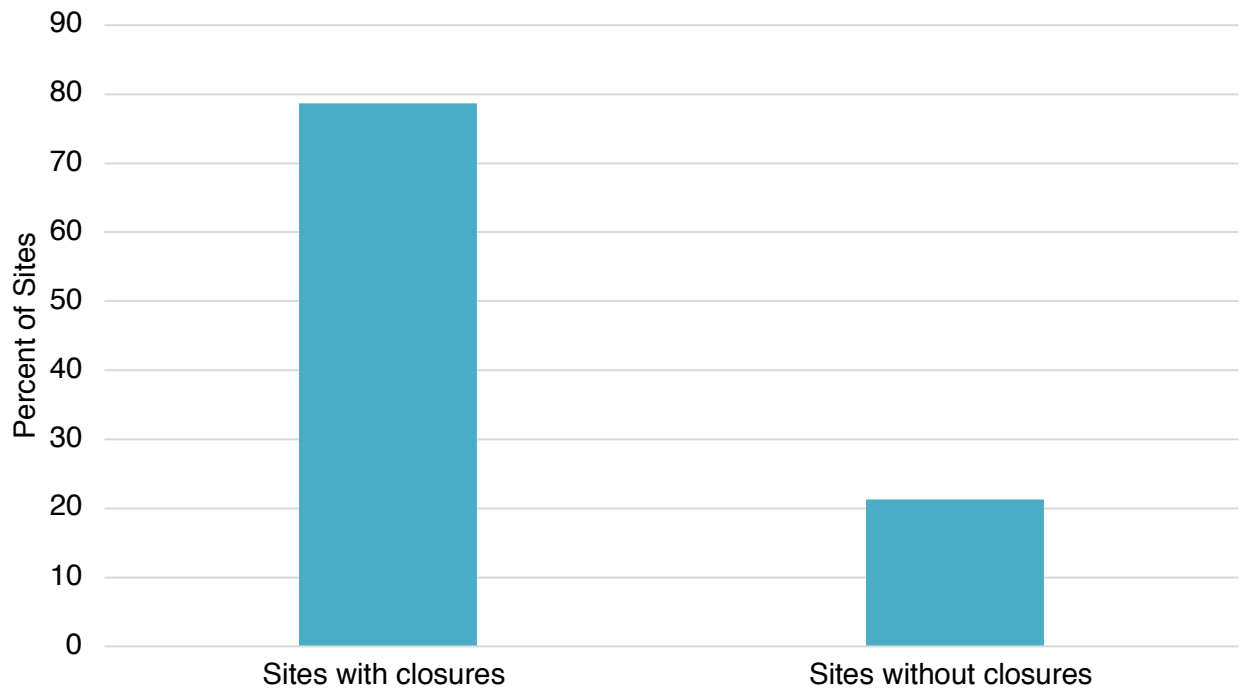
According to the Atlantic Flyway Shorebird Initiative, coastal development, coastal engineering, climate change, human disturbance, invasive plant species, and predators are the greatest threats to shorebirds along the Atlantic Flyway (AFSI, 2015). To understand which of these threats is perceived by managers to be the greatest, participants were asked to rank these threats, with five being the greatest threat. From the mean rank, it was determined that human disturbance ranked as the greatest threat by participants, although this could be due to some level of priming from the previous survey questions all being about human disturbance. Climate change was noted by many participants in the additional comments section to be less proximate of a threat but rather more devastating over time. Nevertheless, it was ranked as the second greatest threat followed by predation, invasive plant species, coastal engineering, and lastly, residential and commercial development. Participants also noted in the comment section that development is not currently a major issue at their sites because the majority of coastal habitats are already developed to the maximum and cannot be further developed (Figure 3).



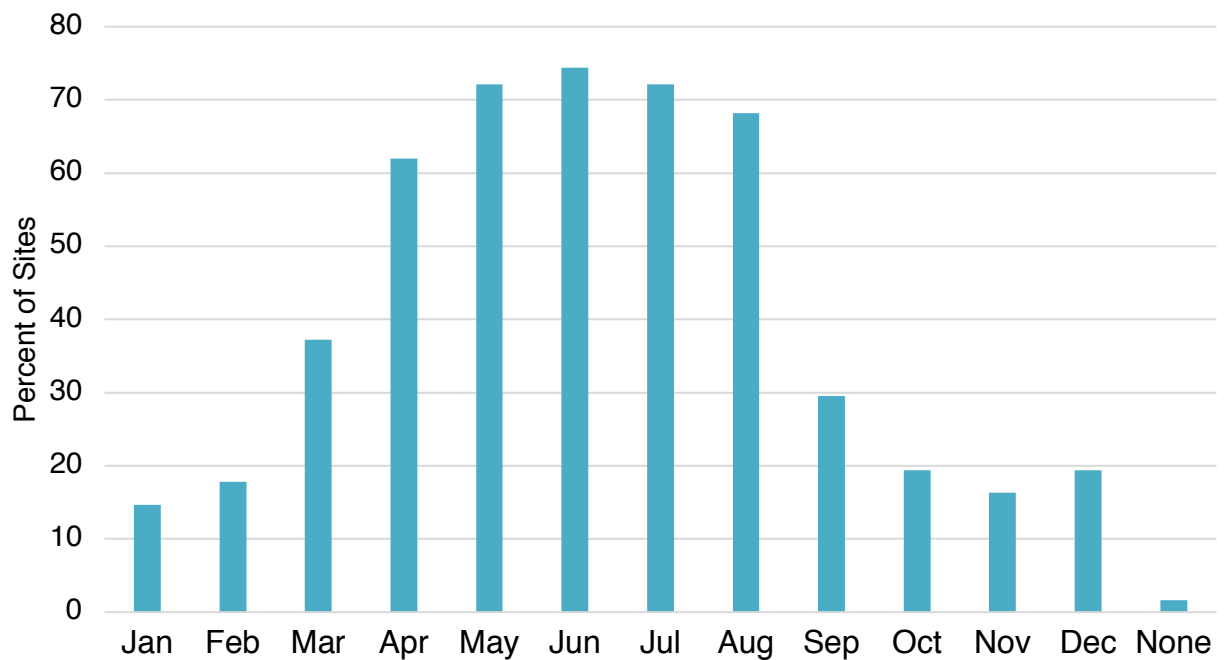
**Figure 3.** The average rank of participants' view of the greatest threats to shorebirds along the Atlantic Flyway with 5 being the greatest threat.

### ***Practices and Techniques to Manage Human Disturbances***

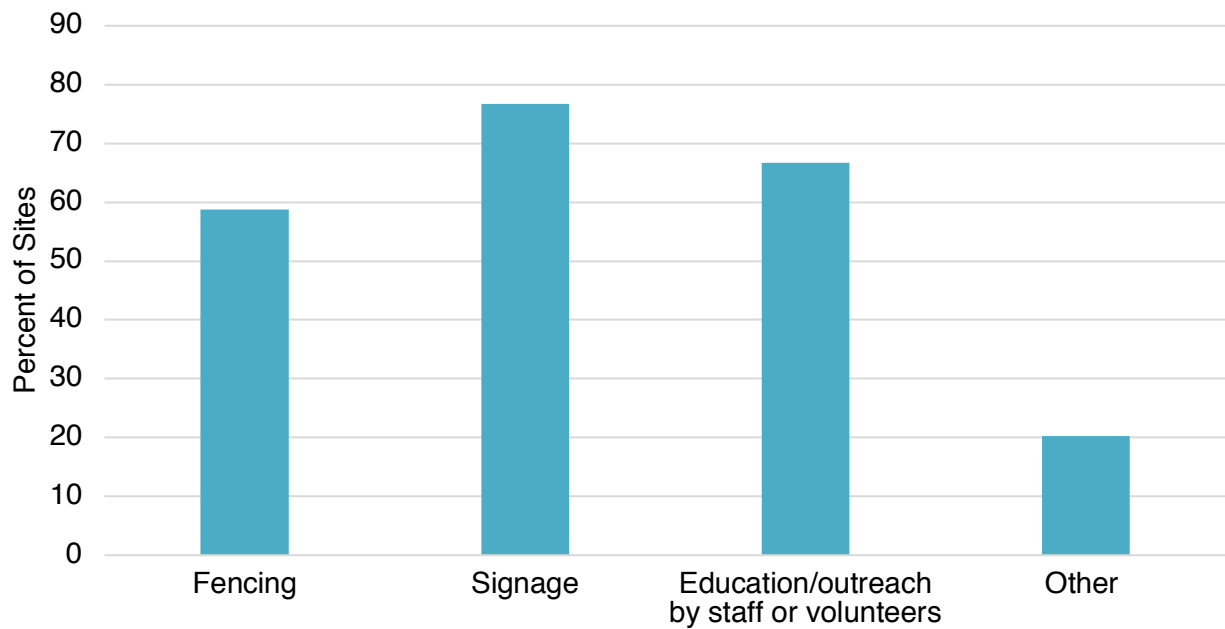
To manage potential human disturbances to shorebirds, approximately 80% of the surveyed sites have full or partial closures at some point during the year (Figure 4). While this is high, the majority of closures occur only five months out of the year. Closures are most common from April through August with over 60% of sites having some type of closure during each of these months. Although there are closures at the beginning of the southward migration season, the percent of sites with closures during the migration season drops by more than half after August with only about 30% of sites having closures. The percent of sites with closures declines even more during the winter season with only between 15-20% of sites maintaining some type of site closure for the protection of shorebirds (Figure 5). When sites are closed, either partially or fully, signs are the predominate form of communication to the public, following, education and outreach, and fencing. Managers also use other forms of communication to relay closures to the public such as digital and social media, websites, press releases, and law enforcement (Figure 6). Managers at over 90% of the site feel that fencing, informal outreach, and signs are the most effective tools to reduce human disturbance and managers at 80% of the sites believe that community engagement and outreach/interpretation efforts are effective (Figure 7). Managers also rated law enforcement as being effective; however, many managers noted that law enforcement staff are limited and spread far apart, causing a portion of managers to note that law enforcement is ineffective due to the lack of presence and the length of time that it takes to respond to an incident.



**Figure 4.** The percent of sites that have full or partial closures at some point during the year to protect shorebirds from potential human disturbance.

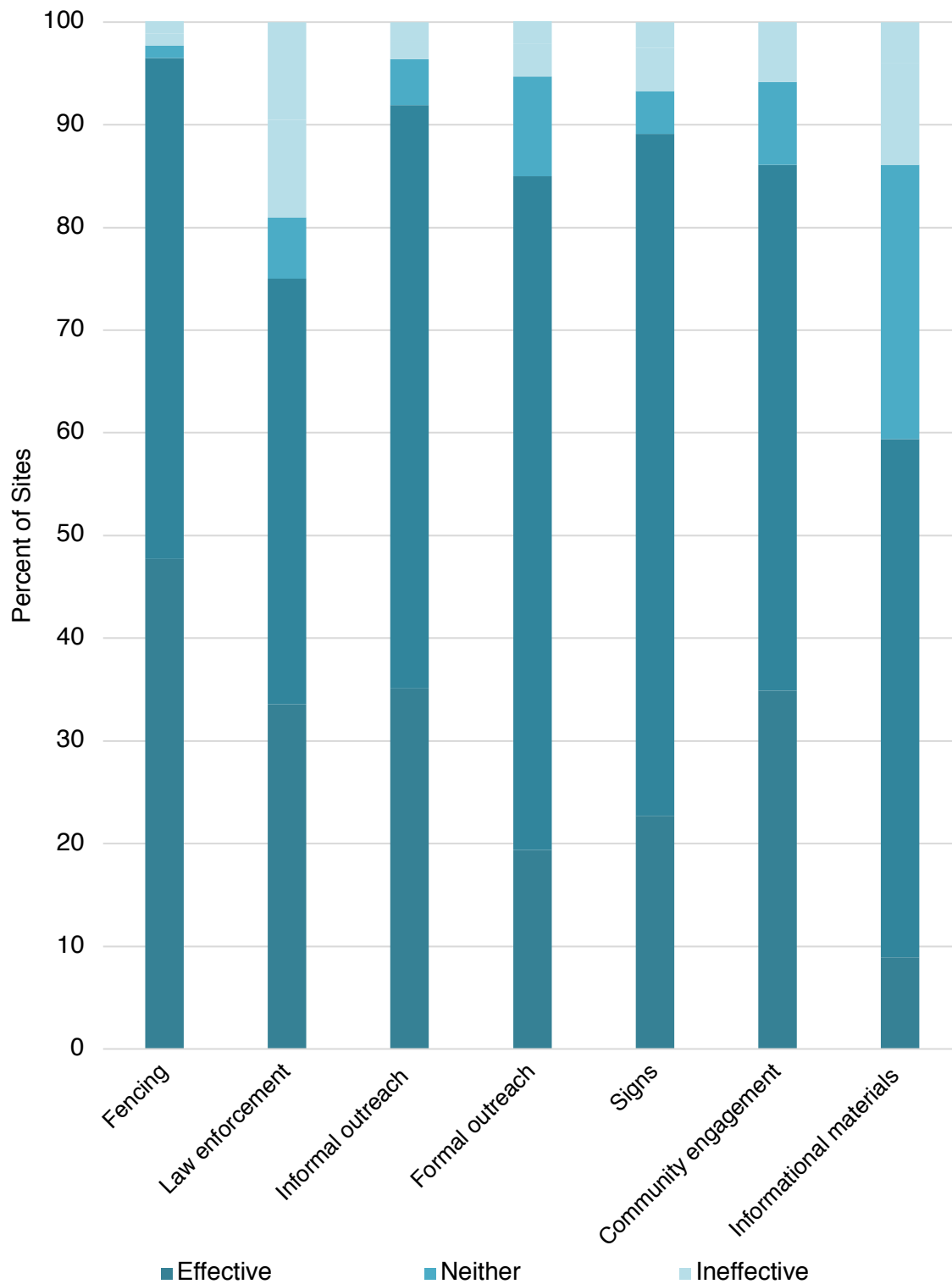


**Figure 5.** The percent of sites that have some type of closure each month to protect shorebirds from potential human disturbance.



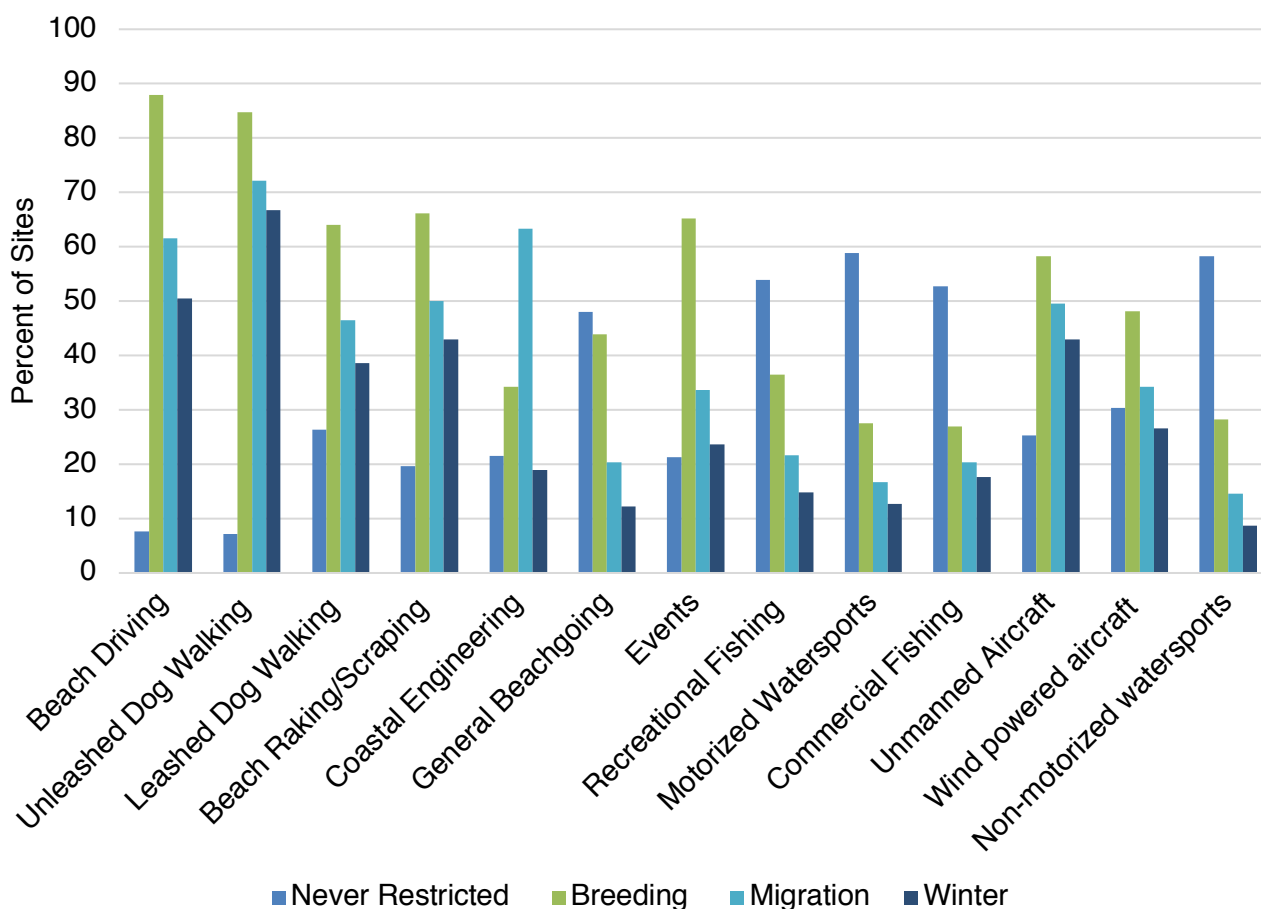
**Figure 6.** The percent of sites that use fencing, signage, education/outreach, and other methods of communication to convey messages about full or partial shorebird closures.





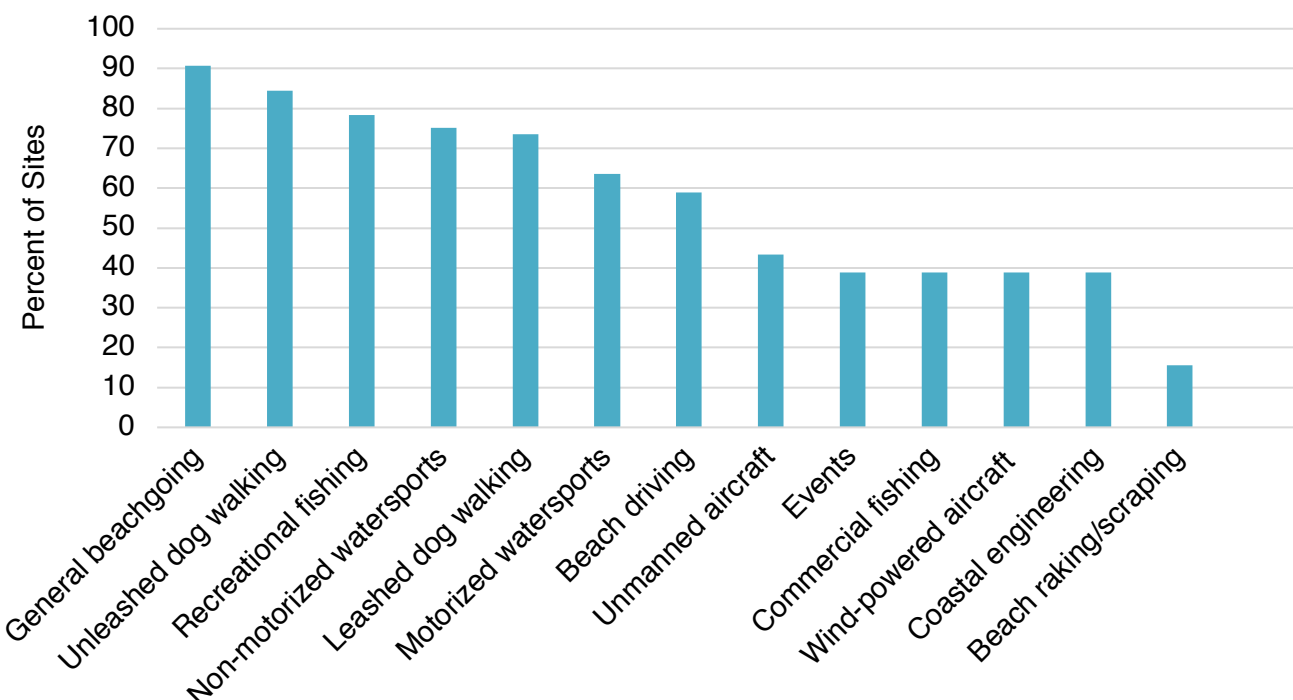
**Figure 7.** The percent of sites in which managers agree that human disturbance management techniques are effective at reducing potential human disturbances.

In addition to closing sites for the protection of shorebirds, many sites also restrict human activities, either partially or completely. Restrictions vary throughout the year with most restrictions occurring during the breeding season, followed by the migration season and then during the winter season. The exception to this is coastal engineering, which is restricted at more sites during the migration season than the breeding season. Out of the thirteen human activities that may cause disturbance to shorebirds, unleashed dog walking is the most commonly restricted activity with over 85% of sites restricting it during the breeding season, over 70% of sites restricting it during the migration season, and over 60% of sites restricting it during the winter season. Specific to the breeding season, beach driving is the most commonly restricted activity at 88% of the sites. Leashed dog walking, events, unmanned aircraft, and beach raking/scraping are also very commonly restricted during the breeding season. All other potential human disturbance activities are restricted at less than half of the surveyed sites (Figure 8). Some activities such as motorized watersports, non-motorized watersports, and recreational fishing are never restricted at over half of the sites.



**Figure 8.** The percent of sites that have restrictions for potential human disturbances during the breeding, migration, and/or winter seasons.

Despite the restrictions at some sites, the 13 types of human activities that may cause disturbance are still present at many sites. The most frequently occurring human activity is general beachgoing with 90% of sites reporting this as an activity that has occurred in the last five years. Unleashed dog walking was also reported frequently, with 85% of sites reporting occurrence (Figure 9). Other activities reported at more than half of the sites were recreational fishing, non-motorized watersports, leashed dog walking, motorized watersports, and beach driving. Activities reported at less than half of the sites were unmanned aircraft, special events, commercial fishing, wind-powered aircraft, coastal engineering, and beach raking/scraping.

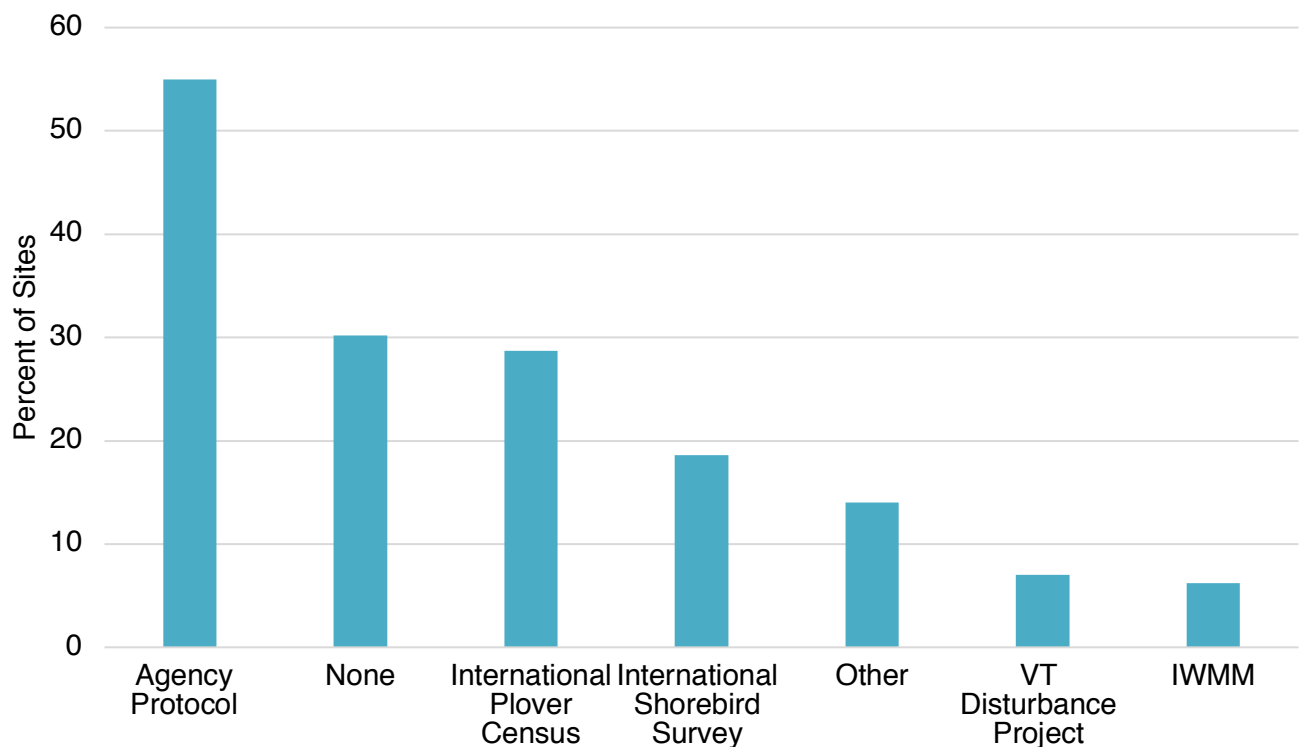


**Figure 9.** The percent of sites where human activities that may cause human disturbance occurred either legally or illegally in the last five years.

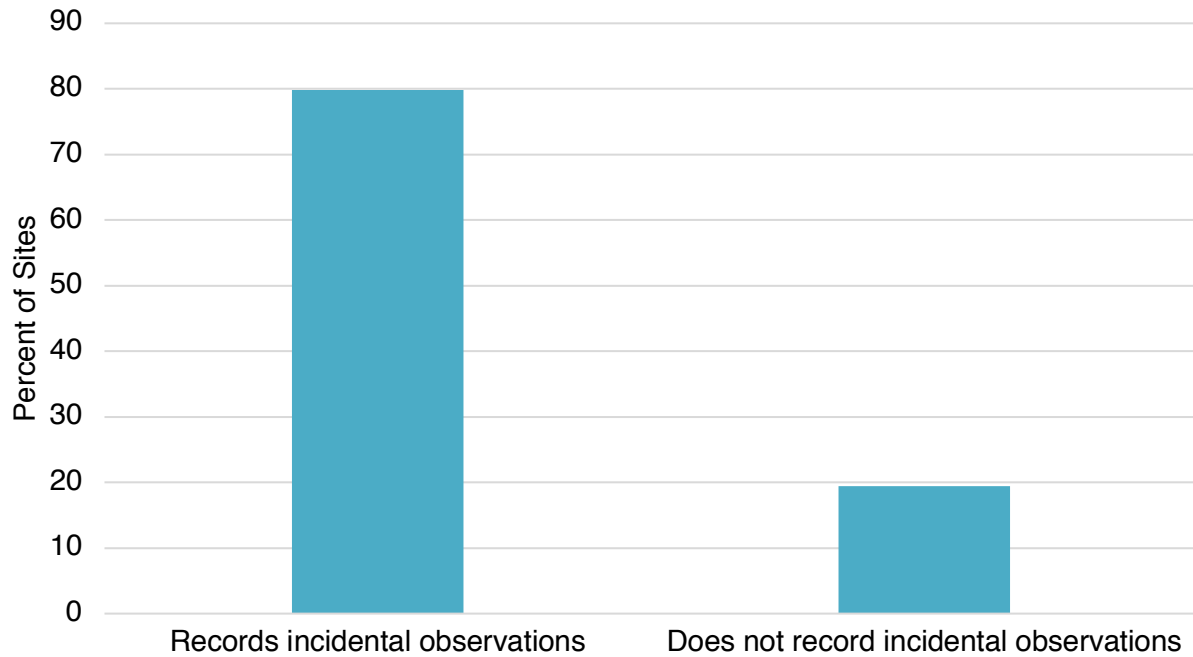
### ***Practices and Techniques to Monitor Human Disturbances***

To monitor the occurrence of these disturbances, about half of the sites use agency specific protocols and less than 30% use each of the systematic protocols we referenced, including the International Plover Census, International Shorebird Survey Integrated Waterbird Management and Monitoring protocol, and the Atlantic Flyway Disturbance Project Protocol. Moreover, 30% of sites noted that they do not conduct any systematic monitoring of human disturbances (Figure 10). Recording incidental observations was much more common with 80% of sites keeping track of disturbance through first-hand observation such as witnessing a person or footprints in a closed area, vehicle tracks in the sand, or vandalism (Figure 11). Monitoring human disturbances also varies by time of year, occurring at about 60% of the sites in April; about 80% from May through August; and about 40% or less from September through

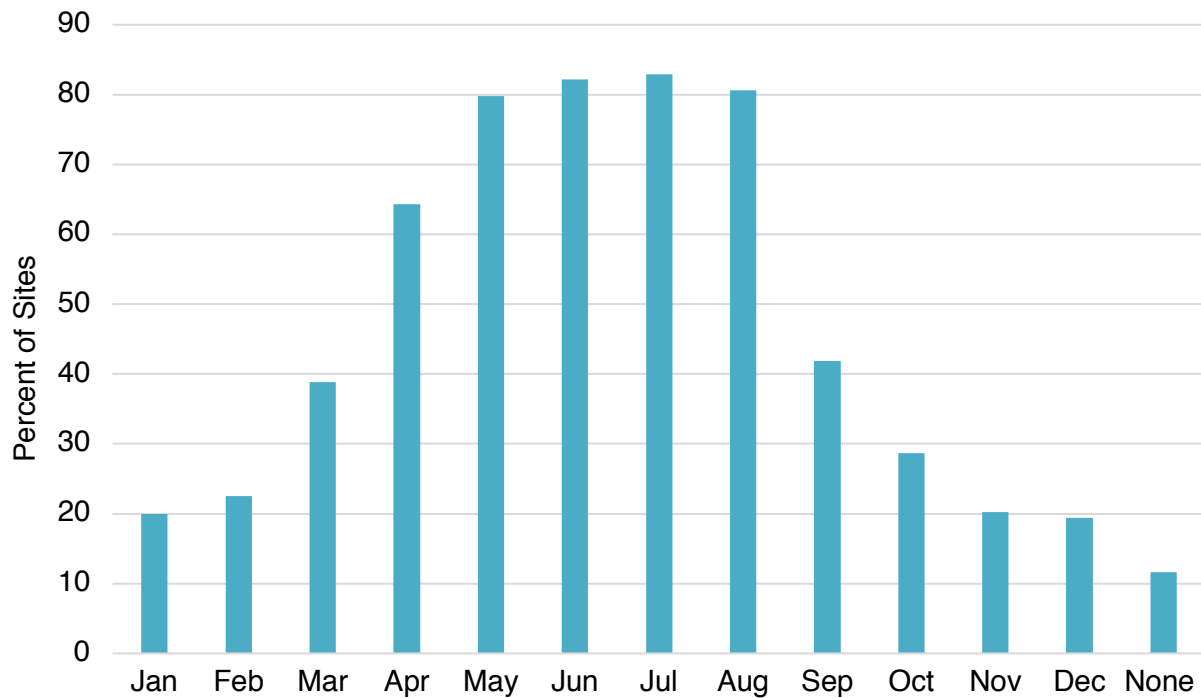
March (Figure 12). About 10% of the sites are never monitored, whether incidentally or systematically.



**Figure 10.** The percent of sites that conduct systematic monitoring of potential human disturbances to shorebirds using the Atlantic Flyway Disturbance Project (VT Protocol), Integrated Waterbird Management and Monitoring protocol (IWMM), International Plover Census, International Shorebird Survey, agency specific protocols, or no protocols.



**Figure 11.** The percent of sites that conduct incidental monitoring of potential human disturbances to shorebirds.

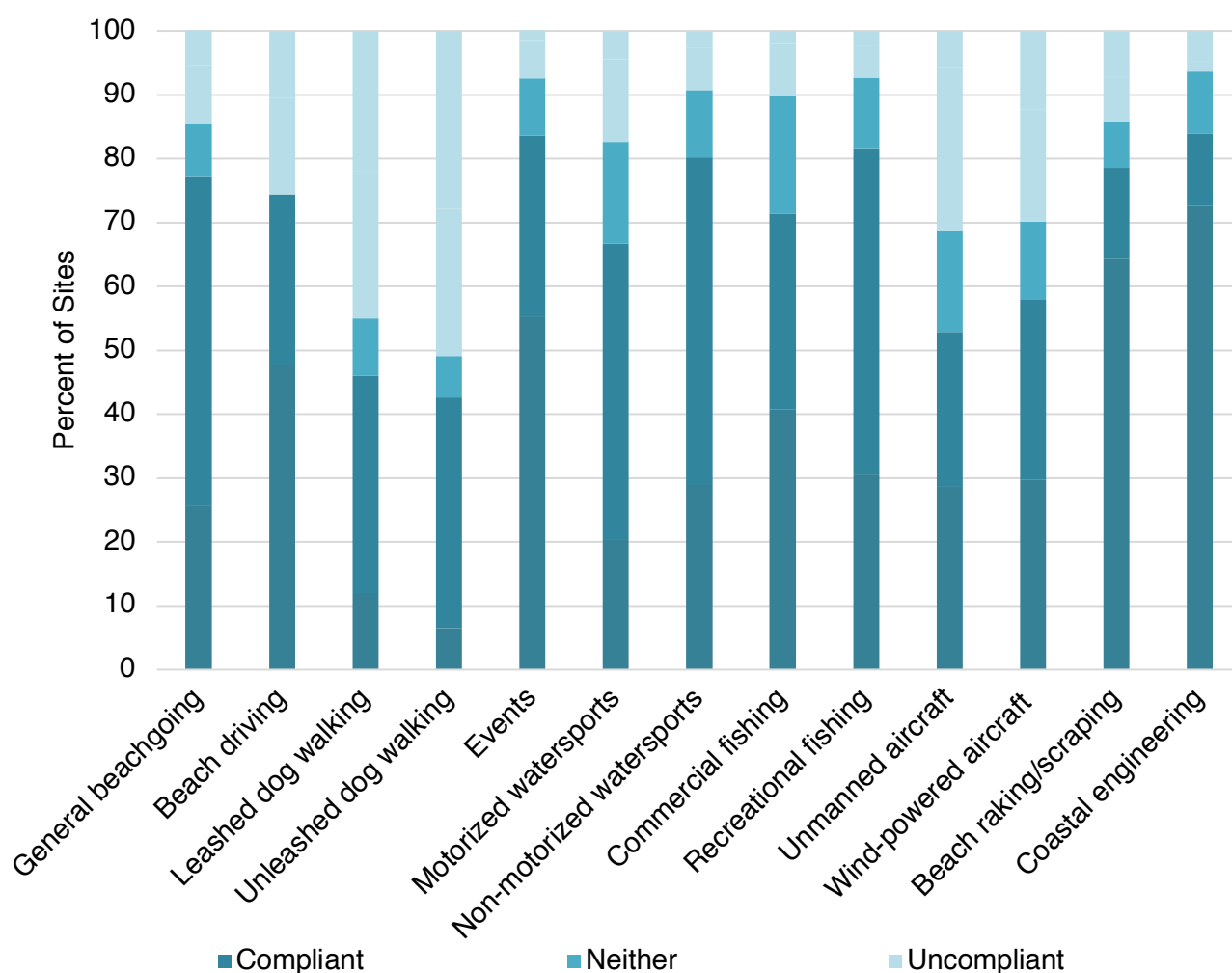


**Figure 12.** The percent of sites that have either incidental or systematic monitoring of human disturbances during each of the months of the year.



### ***Perceptions of Public Response to Human Disturbance Management Practices and Techniques***

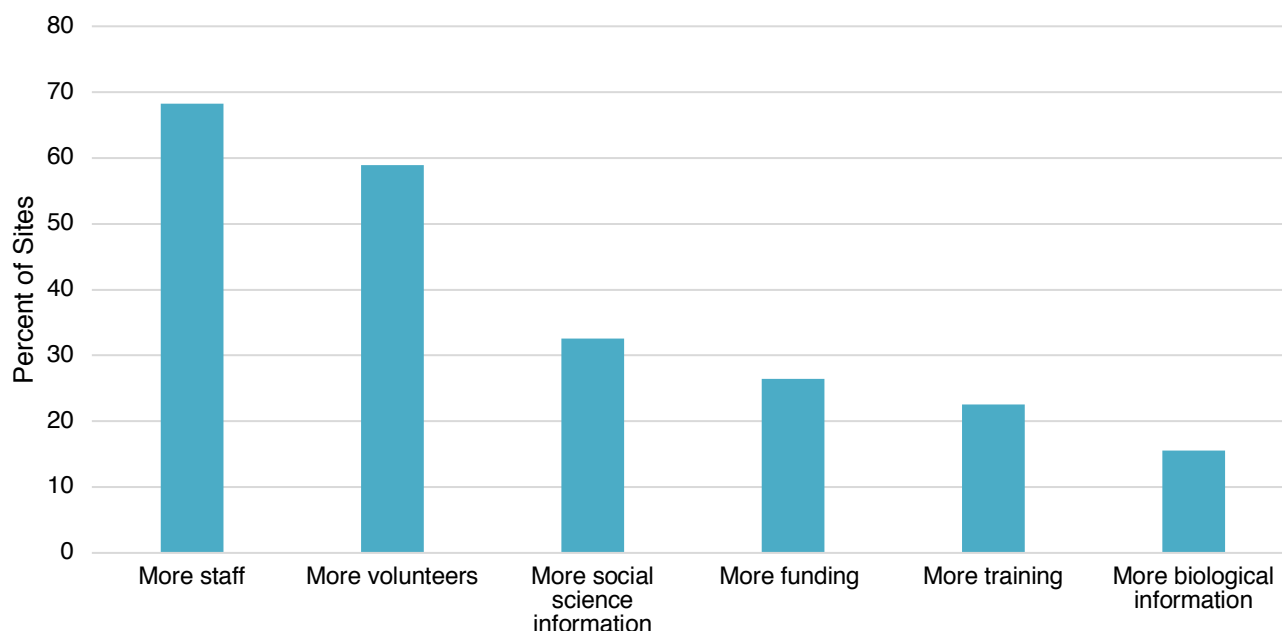
Based on the expert opinion of the survey participants, compliance at the surveyed sites was high for coastal engineering, events, recreational fishing, and non-motorized watersports with about 80% of managers saying that they thought the public was compliant with restrictions relating to these activities. Over half of the surveyed managers also felt that the public was compliant with restrictions relating to beach raking/scraping, general beachgoing, beach driving, commercial fishing, recreational fishing, motorized watersports, wind-powered aircraft, and unmanned aircraft. Conversely, managers felt that out of all the potential human disturbances, unleashed dog walking had the most non-compliance followed by leashed dog walking (Figure 13).



**Figure 13.** The percent of sites in which managers agree that the public is compliant with restrictions relating to potential human disturbances.

## Resource Needs

Managers most commonly noted the need for more staff followed by more volunteers. Some managers also noted that they would like more social science information and training, specifically on how to communicate with the public. Additionally, managers said they could use more funding for non-personnel related expenses such as signs, vehicles, and other forms of equipment (Figure 14).

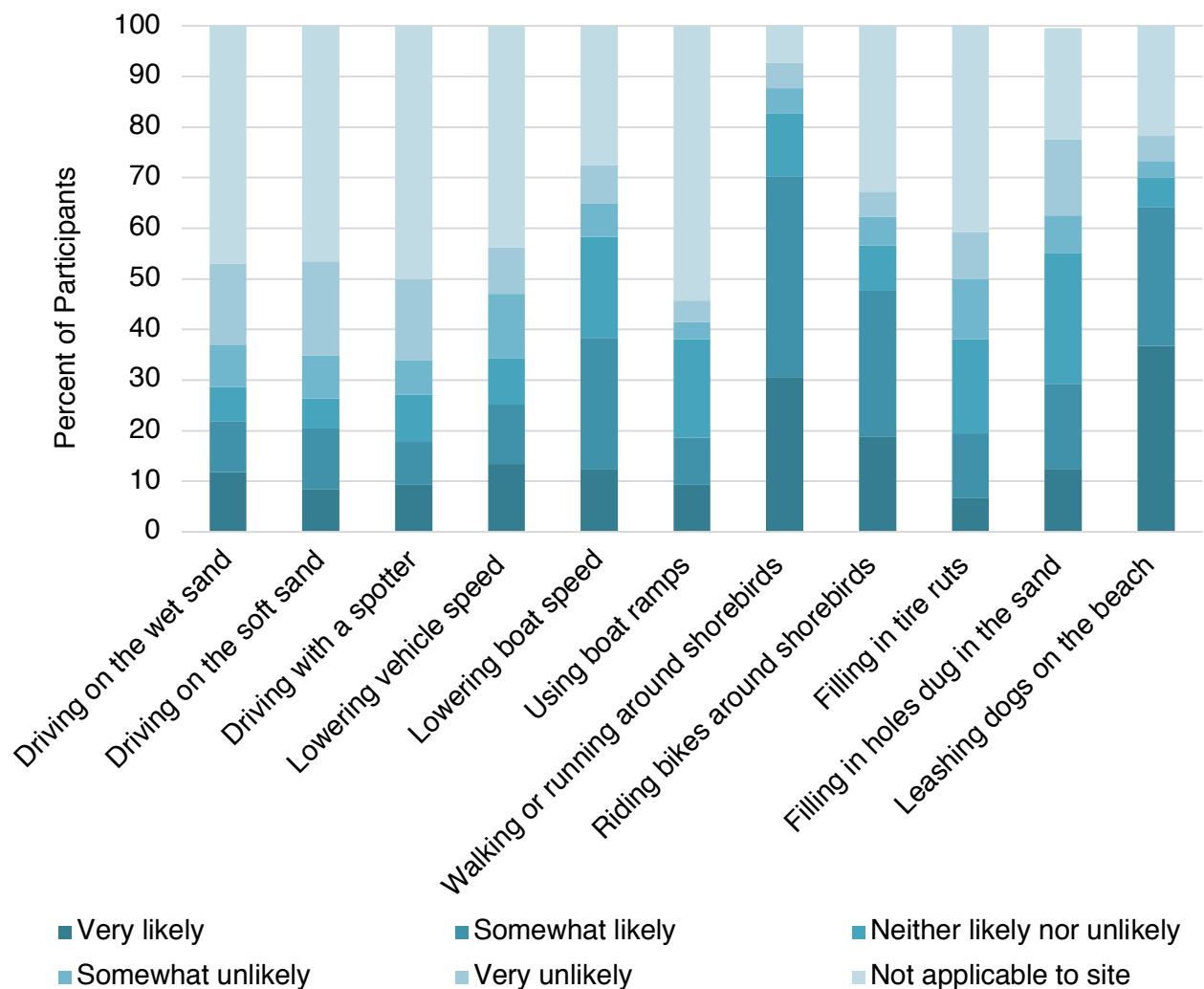


**Figure 14.** The percent of sites in which managers agree that more staff, more volunteers, more social science information, more funding, more training, and more biological information are needed to further efforts to reduce human disturbances to shorebirds.

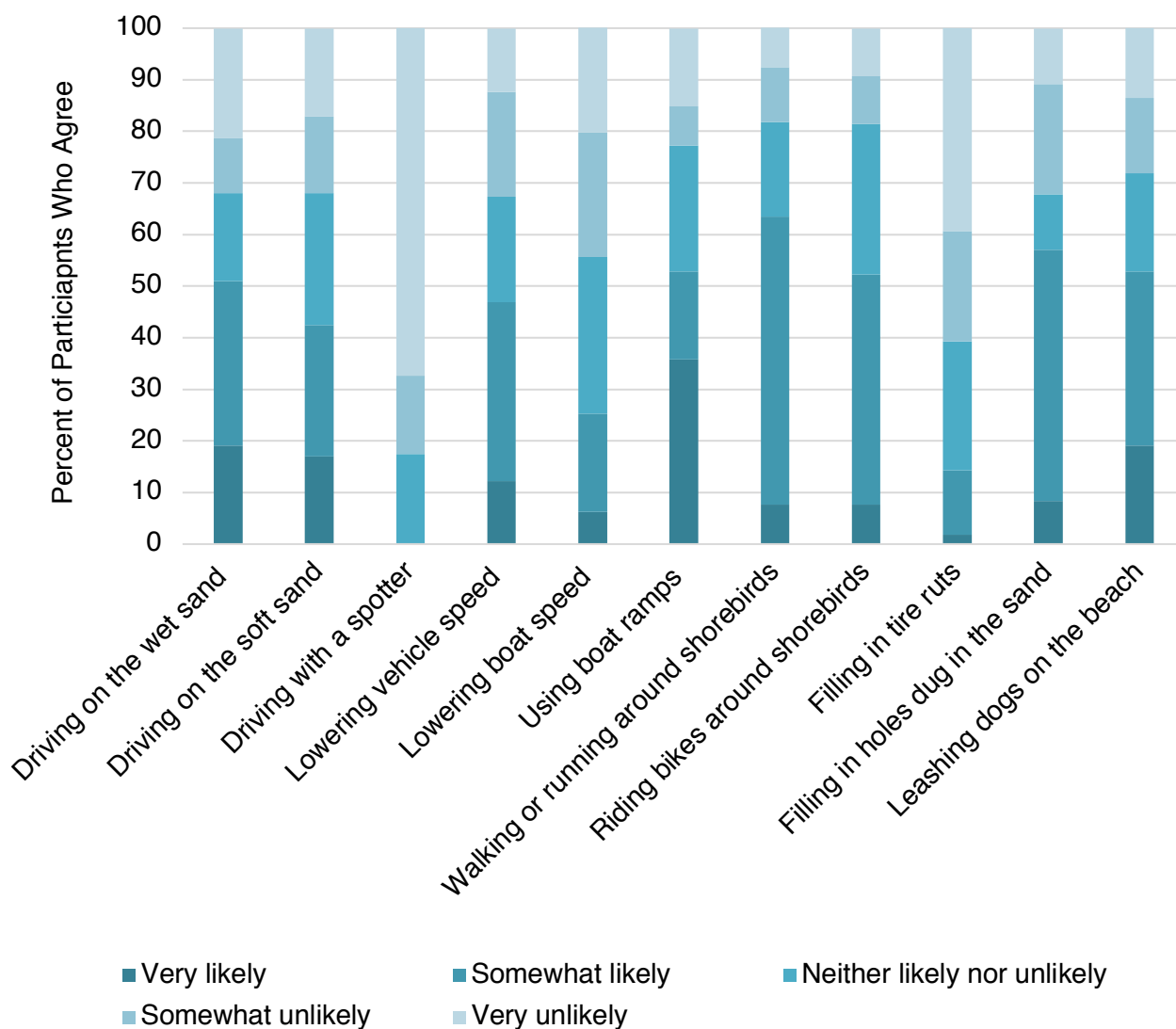
## Characteristics of a Community-based Social Marketing Campaign

Managers were asked about their opinions on potential conservation behaviors (Table 1) that beach recreationists could take to voluntarily decrease human disturbance impacts to shorebirds in order to inform the research for a Community-based Social Marketing Campaign (see Comber & Dayer, 2019). When asked about the impact of these behaviors, managers felt that the top three behaviors that would have the greatest impact at reducing disturbances to shorebirds would be walking or running around a flock of shorebird rather than through them, leashing dogs on the beach, and riding bikes around shorebirds (Figure 15). Managers also rated the likelihood of encouraging people to engage in shorebird conservation behaviors and noted that people were most likely to be encouraged to walk or run around shorebird flocks rather than through them, fill in holes dug in the sand, and leash dogs on the beach (Figure 16). Lastly managers rated the penetration or degree to which these behaviors are already completed. If a behavior has high penetration, then there is little to gain by promoting it so the inverse of the penetration was calculated to see which behaviors

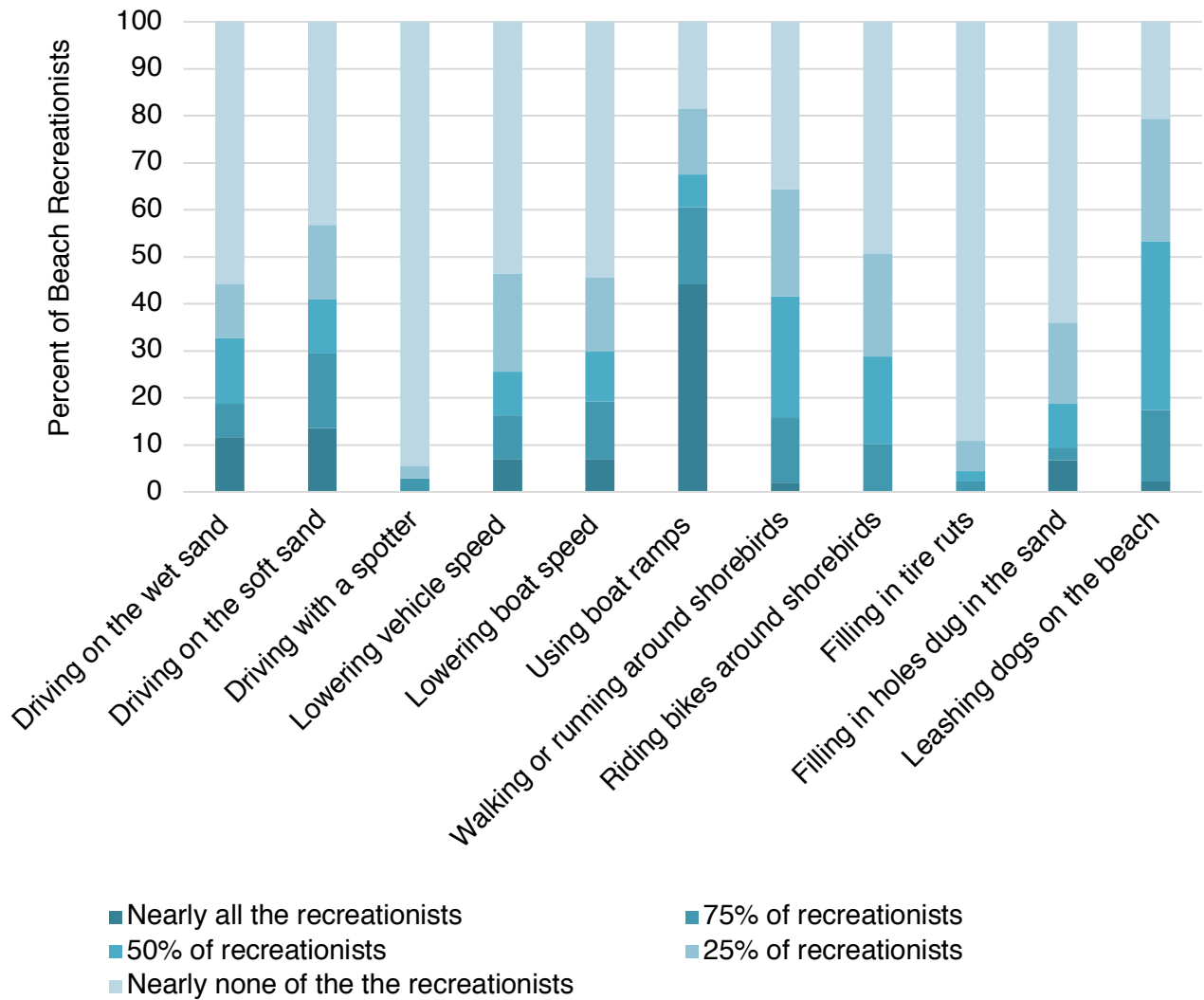
would have the greatest gain if promoted. From the inverse penetration, we found that driving with a spotter, using boat ramps, and walking or running around a flock of shorebird rather than through them were the top three behaviors with the greatest inverse penetration (Figure 17). From this information, the assessments of the behaviors were averaged to provide a combined score for the conservation behaviors that would be most appropriate for a Community-based Social Marketing Campaign. The score averaged the above-mentioned impact, probability of behavior change by beach recreationists, and the invers of penetrations (Table 1). The resulting top three behaviors were walking or running around a flock of shorebird rather than though them; leashing dogs on the beach; and riding bikes around shorebird flocks rather than though them.



**Figure 15.** The percent of participants who agree that the listed behaviors will have an impact on reducing human disturbances to shorebirds at their site(s).



**Figure 16.** The percent of participants who agree that beach recreationists can be encouraged to adopt the listed behaviors at their site(s).



**Figure 17.** The percent of participants who already complete the listed behaviors at their site(s).



**Table 1.** Summary of potential behaviors to promote through community-based social marketing. To determine the most appropriate behavior to promote through CBSM, impact, probability, and inverse penetration were analyzed through an online survey to land managers. The behavior with the highest mean composite of these characteristics is the behavior best suited for CBSM.

Behavior	Impact <sup>a</sup>	Probability <sup>b</sup>	Inverse Penetration <sup>c</sup>	Mean Composite <sup>d</sup>
Walking or running around shorebirds	70.3	63.5	84.3	72.7
Leashing dogs on the beach	64.2	52.8	82.6	66.5
Riding bikes around shorebirds	47.6	52.3	89.8	63.2
Filling in holes dug in the sand	29.2	57.1	90.6	59.0
Lowering vehicle speed	25.2	46.9	83.7	51.9
Driving on the wet sand	21.9	51.0	81.3	51.4
Lowering boat speed	38.3	25.3	80.7	48.1
Driving on the soft sand	20.4	42.5	70.5	44.5
Filling in tire ruts	19.5	14.3	97.8	43.9
Using boat ramps	18.6	57.1	39.5	38.4
Driving with a spotter	17.8	0.00	97.2	38.3

<sup>a</sup> Impact is the percent of land managers who feel that the behavior will minimize human disturbances to shorebirds.

<sup>b</sup> Probability measures the percent of land managers who feel that beach recreationists could be encouraged to do the behaviors.

<sup>c</sup> Penetration is the percent of land managers who feel that the behaviors are already being done by beach recreationists. The inverted values are shown above (100-penetration value) to account for the percent of land managers who do not feel that the behaviors are already being done by beach recreationists.

<sup>d</sup> Mean composite is the average of impact, probability, and inverse penetration.

## Future Directions

This land manager survey aims to provide the Atlantic Flyway Shorebird Initiative, agencies, and organizations with a better understanding of the state of human disturbance management along the Atlantic Flyway. This survey highlights the efforts of managers that are most effective at reducing human disturbances, such as the use of fencing, signs and informal outreach. This information can provide managers with a sense of what practices they should continue to use and what practices they should allocate their efforts and funding towards. The survey also provides managers with

information about areas that need more attention such as monitoring and management during the migrating and wintering seasons.

It also highlights the most prominent human activities that may cause disturbance along the Atlantic Flyway such as unleashed and leashed dog walking. With this knowledge, managers can better work together to create effective approaches to manage these activities, such as increasing signage, emphasizing informal outreach about these topics, and training shorebird staff and monitors about effective communication methods to reduce these disturbances.

In addition to providing managers with information to improve their efforts at reducing human disturbances, this survey highlights the need for a standardized protocol to monitor human disturbance. The implementation of a standard protocol could be beneficial for evaluating the state of human disturbance over a long-term period and could aid managers in identifying disturbance trends. The Atlantic Flyway Shorebird Initiative could play a role in implementing the adoption of a protocol such as the standard operating procedures and the data sheets found in Appendix C of the phase 1 final biological report, which are adaptable and flexible to meet the needs of managers across the Atlantic Flyway who encounter diverse habitats and situations.

Additionally, this survey can provide agencies and organizations such as those involved in the Atlantic Flyway Shorebird Initiative with information about how to better support shorebird managers, such as through efforts to garner more staff and volunteers. While funding may be limited to provide more staff, managers can be supported in other ways by receiving information on how to create high quality interpretive signs that can communicate messages in the absence of staff, how to better recruit and train volunteers, how to acquire interns to fill short term staffing needs, or how to partner with local academic institutions to address research and monitoring needs. AFSI may also be able to facilitate efforts for shared positions (e.g., law enforcement officers and outreach docents) amongst key shorebird sites in similar geographic areas.

Lastly, the land manager survey provides a list of behaviors that through expert opinion have been rated as having the most potential to reduce human disturbances to shorebirds and would be most appropriate to target with a community-based social marketing campaign (McKenzie-Mohr, 2011). These behaviors include walking or running around a flock of shorebirds rather than through them, which could be useful for non-breeding shorebirds that are not protected by symbolic fencing, leashing dogs on the beach, and riding bikes around a flock of shorebirds rather than through them. Since the barriers and benefits to these behaviors are unknown, the next step in creating a behavior change campaign would be to investigate them through interviews, observations, and surveys. We have conducted this research related to dog walking as another part of this collaborative project, which you can find in our report *Social Science Report Part II: Understanding Beach Recreationists*. We recommend future research addressing the barriers and benefits to the other two behaviors. Once this is done, a strategy can be developed to promote these behaviors and reduce disturbances.

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## Appendix A: Land Manager Survey



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### Default Question Block

We are interested in learning about efforts to reduce human disturbances to shorebirds at the site(s) that you manage within the \${e://Field/IBA%20Site} Important Bird Area (IBA). To view a map of this IBA region that we would like to learn more about, copy and paste this URL into your internet browser: \${e://Field/URL}

This questionnaire should take 20-30 minutes. Your participation in this survey is voluntary, and your identity will be kept confidential. There are no known risks associated with this research.

For questions or concerns about this research, please contact Carolyn Comber at ccomber1@vt.edu or (831)-855-5906. Should you have any questions or concerns about this study's conduct or your rights as a research subject, you may contact the Western Institutional Review Board® (WIRB®) at [Help@wirb.com](mailto:Help@wirb.com) or [1-800-562-4789](tel:1-800-562-4789)

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Do you consent to participate in this research study?

- ☐ Yes  
☐ No

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### Block 1

We would like to know the names of the site(s) that you manage within the \${e://Field/IBA%20Site} IBA. Please list the sites that you manage below.



The Atlantic Flyway Shorebird Initiative has identified the following fifteen shorebirds as focal species that represent other Atlantic Flyway shorebird species that share similar conservation needs.

Which of the following focal species do you have at your site(s) within the \${e://Field/IBA%20Site} IBA on an annual basis (occurring each year)? Select all that apply.

- ☐ American oystercatcher
  - ☐ American golden plover
  - ☐ Greater yellowlegs
  - ☐ Lesser yellowlegs
  - ☐ Marbled godwit
  - ☐ Piping plover
  - ☐ Purple sandpiper
  - ☐ Red knot
  - ☐ Red-necked phalarope
  - ☐ Ruddy turnstone
  - ☐ Sanderling
  - ☐ Semipalmated plover
  - ☐ Snowy plover
  - ☐ Whimbrel
  - ☐ Wilson's plover
- 

## Block 2

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In this survey, we define human disturbance 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.

What *systematic protocols*, if any, are used to monitor potential human disturbances to shorebirds at your site(s) within the \${e://Field/IBA%20Site} IBA? Select all that apply.

- ☐ Atlantic Flyway Disturbance Project (protocol from VT Shorebird Program)
  - ☐ Integrated Waterbird Management and Monitoring (IWMM)
  - ☐ International Plover Census
  - ☐ International Shorebird Survey
-

- ☐ Agency or organization specific protocols
- ☐ No protocols are used to systematically monitor human disturbances at this site
- ☐ Other (please specify)
- 

Are *incidental observations* of potential human disturbances to shorebirds recorded at your site(s) within the `$(e://Field/IBA%20Site)` IBA, (E.g., visual observation by staff/volunteers, footprints in closed areas, people walking dogs on the beach, etc.)?

- ☐ Yes
- ☐ No
- 

During which months are potential human disturbances recorded through systematic protocols or through incidental observations at your site(s) within the `$(e://Field/IBA%20Site)` IBA? Select all that apply.

- ☐ January
- ☐ February
- ☐ March
- ☐ April
- ☐ May
- ☐ June
- ☐ July
- ☐ August
- ☐ September
- ☐ October
- ☐ November
- ☐ December
- ☐ None of the above
- 

### Block 3

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There are a variety of human activities that may cause disturbance. A range of considerations at the site level determine whether these activities are allowed. Despite best efforts, some human activities that are restricted may still occur at shorebird sites even if they are not permitted. We would like to learn more about the legal and illegal human activities that occur at your sites.

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Within the last five years, which human activities have been known to occur at your site(s) either legally or illegally? Select all that apply.

- ☐ General beachgoing (walking, running/jogging, beach combing, sunbathing, picnicking, ball playing, frisbee, other beach games, camping, swimming, bike riding)
- ☐ Beach driving (4x4, ATV/UTV, beach buggies, ORV, OSV)
- ☐ Unleashed dog walking
- ☐ Leashed dog walking
- ☐ Events (fishing tournaments, festivals, parties, sport competitions, fireworks)
- ☐ Motorized watersports (boats, airboats, speedboats, jet-skis)
- ☐ Non-motorized watersports (Kayak, canoe, stand up paddleboard, sailboats, kite boarding, kite surfing, wind surfing, skimboarding)
- ☐ Commercial fishing (aquaculture, oyster racks, mariculture, horseshoe crab harvest, clamming, worm digging, seaweed harvest)
- ☐ Recreational fishing and shellfishing (surf fishing, fishing, shell-fishing, clamming, worm-digging, crabbing, bait collection)
- ☐ Unmanned aircraft (drones, UAVs, model aircraft, unmanned remotely operated toys, rocket launches)
- ☐ Wind-powered aircraft (paragliding, hang gliding, kite flying, kite skating, sand-yachting or cart sailing)
- ☐ Beach raking/scraping
- ☐ Coastal engineering (beach nourishment, artificial dune stabilization, construction project)
- ☐ Other (please specify)

Activities on the beach may be restricted for the protection of shorebirds during the breeding season (April-June), the migration season (July-November), and/or the winter season (December-March). For each activity, please select the season(s) in which each activity is restricted, if at all restricted at your site(s).

	Never restricted	Breeding	Migration	Winter	Not applicable to site(s)
Beach driving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unleashed dog walking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Leashed dog walking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beach raking/scraping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General beachgoing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recreational fishing and shellfishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Motorized watersports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Commercial fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unmanned aircraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wind powered aircraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-motorized watersports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="text"/>					

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#### Block 4

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Many factors contribute to public compliance of restricted activities. Compliance might vary from one site to another. We would like to learn about public compliance at your site(s) for the activities listed below. There are no right or wrong answers.

Based on your experience and/or data from your site(s), to what extent do you think the public is compliant with restrictions related to the following activities?

	Very compliant	Somewhat compliant	Neither compliant nor	Somewhat uncompliant	Very uncompliant	Not applicable to site(s)
Beach driving	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unleashed dog walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leashed dog walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beach raking/scraping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coastal engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General beachgoing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recreational fishing and shellfishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motorized watersports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial fishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unmanned aircraft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wind powered aircraft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-motorized watersports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="text"/>						

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## Block 5

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Some sites completely or partially close areas to protect shorebirds from human disturbance. This may occur year-round or seasonally. We would like to learn more about the closed areas, if any, at your site(s).

Do you have closed areas to protect shorebirds from potential human disturbance at your site(s)?

- ☐ Yes
- ☐ No
- 

During which months are areas at your site(s) closed for the protection of shorebirds? Please select all that apply.

- ☐ January
- ☐ February
- ☐ March
- ☐ April
- ☐ May
- ☐ June
- ☐ July
- ☐ August
- ☐ September
- ☐ October
- ☐ November
- ☐ December
- ☐ None of the above
- 

How are closed areas communicated to beach recreationists at your site(s)? Select all that apply.

- ☐ Fencing
- ☐ Signage
- ☐ Education/outreach by staff or volunteers
- ☐ Other (please specify)
-

## Block 6

We would like to learn about your experiences with human disturbance management as well as your thoughts on the resources needed to continue managing human disturbances to shorebirds in the future.

Based on your experience and/or data from your site(s), to what extent are the following practices effective at reducing human disturbances to shorebirds?

	Very effective	Somewhat effective	Neither effective nor ineffective	Somewhat ineffective	Very ineffective	Not applicable to site(s)
Fencing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Signs (official postings, interpretive kiosks)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Informal outreach by staff and volunteers during monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Outreach/interpretation efforts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Informational materials (brochures, fliers, activity pages)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Law enforcement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Community engagement/ stewardship (volunteer dog monitors, education docents, citizen science)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What resources do you think would improve your efforts to reduce potential human disturbances to shorebirds at your site(s)? Select all that apply.

- ☐ More training
- ☐ More staff
- ☐ More volunteers
- ☐ More funding for needs that aren't personnel related
- ☐ More biological information
- ☐ More social science information
- ☐ Other (please specify)

## Block 7

We would like to know *your* thoughts on the following behaviors that visitors to your site could be encouraged to undertake with the goal of reducing disturbance to shorebirds.

In your opinion, if beach recreationists were to undertake the following behaviors, how likely or unlikely would it be for each behavior to minimize actual human disturbance to shorebirds at your site(s)? (Please do not comment based upon the feasibility of each behavior at this time).

	Very likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Very unlikely	Not applicable to my site(s)
Driving on the wet sand (for breeding season)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving on the soft sand/above mean high tide (for migration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving with a spotter in front of vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering vehicle speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering boat speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using boat ramps to launch and pull out boats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking or running <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding bikes <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in tire ruts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in holes dug in the sand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leashing dogs on the beach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For what proportion of your sites' beach recreationists are the following behaviors applicable? We define applicability as the behavior is relevant for these individuals. (E.g., "Driving on the wet sand (for breeding season)" would be "applicable" for the proportion of your beach recreationists who drive on the sand in the summer.) Please provide an estimate based on your experience at your site(s).



	Nearly all the recreationists	About 75% of recreationists	About 50% of recreationists	About 25% of recreationists	Nearly none of the recreationists
Driving on the wet sand (for breeding season)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving on the soft sand/above mean high tide (for migration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving with a spotter in front of vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering vehicle speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering boat speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using boat ramps to launch and pull out boats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking or running <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding bikes <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in tire ruts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in holes dug in the sand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leashing dogs on the beach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Block 10

Now we are interested in what proportion of beach recreationists at your site(s) already complete these behaviors. (E.g., What percent of recreationists who bring a dog to the beach keep it on a leash? Or what percent of beach recreationists fill in holes after they dig them in the sand?) Please provide an estimate based on your experience at your site(s).

	Nearly all the recreationists	About 75% of recreationists	About 50% of recreationists	About 25% of recreationists	Nearly none of the recreationists	Not applicable to my site(s)
Driving on the wet sand (for breeding season)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Driving on the soft sand/above mean high tide (for migration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving with a spotter in front of vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering vehicle speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering boat speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using boat ramps to launch and pull out boats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking or running <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding bikes <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in tire ruts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in holes dug in the sand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leashing dogs on the beach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Now we are interested in feasibility. Rate how likely or unlikely it would be to encourage beach recreationists to do the following activities at your site(s).

	Very likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Very unlikely	Not applicable to my site(s)
Driving on the wet sand (for breeding season)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving on the soft sand/above mean high tide (for migration)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Driving with a spotter in front of vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering vehicle speed near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lowering boat speed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

near shorebirds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using boat ramps to launch and pull out boats	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking or running <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Riding bikes <u>around</u> a flock of shorebirds, rather than thru	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in tire ruts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Filling in holes dug in the sand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leashing dogs on the beach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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### Block 8

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The Atlantic Flyway Shorebird Initiative has identified the following to be key threats to shorebird conservation. We would like to know what *you think* are the greatest threats to shorebird conservation at your site(s).

Reorder the items below by dragging them so that the most threatening item is listed at the top and the least threatening item is listed at the bottom.

Climate change

Coastal engineering (E.g., beach nourishment, dune stabilization, construction project)

Human disturbance

Invasive plant species (E.g., non-native plants that harm humans or the environment)

Predation of shorebirds

Residential and commercial development

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### Block 9

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Lastly, we would like to know some information about your site(s) within the  $\{e://Field/IBA\%20Site\}$  IBA and

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the people that visit and/or work there.

---

What is your job title?

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We are interested in the number and types of staff/volunteers at your site(s). Please check the boxes for the types of staff that you have and enter the approximate numbers of each type.

- ☐ Full-time biologist
- ☐ Seasonal biologist
- ☐ Seasonal intern/technician
- ☐ Full-time outreach coordinator
- ☐ Seasonal outreach coordinator
- ☐ Full-time law enforcement
- ☐ Seasonal law enforcement
- ☐ Volunteers
- ☐ Other (please specify the position and number of people in the position)

---

Approximately how many people visit your site(s) annually?

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Select the types of shorebird habitat that exist at your site(s). Please select all that apply.

☐ Sandy beach

- ☐ Rocky beach
  - ☐ Intertidal
  - ☐ Mangrove
  - ☐ Saltmarsh
  - ☐ Mudflat
  - ☐ Estuary
  - ☐ Human-made substrate (E.g., rock armour, rooftop)
- 

#### Block 11

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Thank you for participating in this survey. The data from this survey will be compiled into a database that will be available to the National Audubon, National Fish and Wildlife Foundation, and other managers or biologists who request information. We would like to know if you are willing to have the information you provided in this survey associated with the names of your sites in this IBA. Such information could aid users of the database in working with managers. You may choose instead to not have the names of your sites associated with your responses. Either way, we will not include the names of any participants in this study in the database or in any other reporting.

- ☐ Yes, my site(s) can be associated with my responses
  - ☐ No, I do not want my site(s) associated with my responses
- 

Do you have any additional comments that you would like to add?

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Once you click submit, you will not be able to go back and change your responses in the survey. Are you ready to complete the survey by clicking submit?

- ☐ Yes
- ☐ No



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

**National Audubon Society**  
[www.audubon.org](http://www.audubon.org)

**Dayer Human Dimensions Lab**  
<http://www.dayer.fishwild.vt.edu/>

**Virginia Tech Shorebird Program**  
<http://vtshorebirds.fishwild.vt.edu>

**National Fish and Wildlife Foundation**  
[www.nfwf.org](http://www.nfwf.org)