# Atlantic Flyway Disturbance Project

## • Biological Data Interim Report •

*DRAFT*

• Report prepared by •

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# Table of Contents

# EXECUTIVE SUMMARY


### Background

Human disturbance is a significant threat facing shorebirds throughout the annual cycle, and threats to shorebird habitats may be exacerbated by increased human use (e.g., beach recreationists, off-leash dogs), reducing the amount of coastal habitat that is functionally available to shorebirds. We worked with partners across the flyway to develop a standardized protocol for data collection to evaluate the effects of human disturbance on five AFSI focal species.

### Methods

Project partners collected data at 35 sites from Nova Scotia to Florida. We randomly chose sites with varying levels of potential disturbance types and shorebird abundance. Point counts and behavioral samples were performed at these sites every 1–2 weeks. We also collected breeding season productivity data and site level information to categorize sites. We determined the extent to and mechanism by which potential disturbances influenced shorebird abundance by using zero-inflated Poisson regression. We determined the association between the species behavior and the extent of current, nearby potential disturbances with a multinomial regression.

### Results

The frequency of key potential disturbances (e.g., dogs, people), abundances of focal species, and protection measures implemented varied substantially among the sites selected for the study. On average, we found fewer people where some or all of a point was closed, suggesting that site closures, to an extent, were effective at reducing the number of people that access an area. Moreover, there were consistent, negative correlations between shorebird presence and abundance and the number of people and the presence of dogs. Behaviorally, we found that American Oystercatchers and piping plovers spent more time resting in closed areas, and both were more alert when dogs were present.

### Future Directions

Shorebirds in this study were appeared to avoid sites with a greater abundance of people and where dogs were present. They behaved differently in these situations also, resting less and spending more time alert, which offers insight into potential mechanisms behind our observed counts. Closures appeared effective at reducing the frequency of disturbance, suggesting that efforts to lessen disturbance frequency and intensity could improve the quality and carrying capacity of some habitats.

These protocols provide a standardized way of measuring potential disturbances at a flyway scale, and can be used as metrics to assess the success of any attempts to lessen disturbance both in terms of the occurrence of these activities and in terms of the

response of shorebirds to any changes. The data presented here and collected throughout the first year are a baseline measure of the abundance and distribution of potential disturbances, management strategies, and focal species. The protocol has expanded to other, related sites in Georgia and South Carolina, and there has been interest from other parties as well. In addition, we are working to pair biological data collection and results with the findings from land manager surveys and surveys of dog walkers on selected beaches to inform the Community Based Social Marketing piece of this project.

## INTRODUCTION

Worldwide, shorebird populations are declining, with rapid declines reported for temperate breeding and coastal species (Brown et al. 2001). Habitats for shorebirds are being lost or degraded due to coastal alterations, including beach nourishment, inlet stabilization, sand mining, construction of dunes, groins, seawalls and revetments, and wrack removal, as well as potentially threatened by climate change through sea-level rise and changes in storminess (U.S. Fish and Wildlife Service 2012). In addition, threats to shorebird habitats are further exacerbated by increased human use (e.g., beach recreationists, off-leash dogs, off-road vehicles) that can reduce the amount of coastal habitat that is functionally available to shorebirds (Foster et al. 2009, Tarr et al. 2010).

Although many human activities are perceived by beachgoers as ecologically benign (Williams et al. 2009), disturbance by humans can affect shorebirds throughout their annual cycle. For breeding shorebirds, these effects include the exclusion or abandonment of otherwise suitable nesting or foraging habitat, crushing of nests or chicks, nest abandonment, exclusion of pre-fledged chicks from foraging habitats, reduced foraging rates, slow growth or reduced body mass of chicks, and reduced nest or chick survival (e.g., Flemming et al. 1988, Burger 1991, 1994; Patterson et al. 1991, Lord et al. 1997, Ruhlen et al. 2003, Weston and Elgar 2005, Colwell et al. 2005, Que et al. 2015, DeRose- Wilson et al. 2018). For non-breeding shorebirds, disturbance can result in reduced foraging time and efficiency, impacts to prey, exclusion or abandonment of otherwise suitable roosting and foraging habitat, and increased energetic costs, which together can reduce individual body condition, survival, or other fitness components, potentially leading to local population declines (e.g., Lafferty 2001, Thomas et al. 2003, Foster et al. 2009, Tarr et al. 2010, Schlacher et al. 2013, Burger and Niles 2013, Gibson et al. 2018)

Effectively managing the influence of human disturbance and other environmental variability on population demographic processes is a primary goal for natural resource managers. As a result, human disturbance has been recognized by the Atlantic Flyway Shorebird Initiative (AFSI; Threat 4.3; Strategy 2.3), shorebird researchers, and managers of important shorebird habitats as one of the most significant threats facing shorebirds during breeding, migration, and winter. Furthermore, it is a threat that is likely to increase over time as more people inhabit the coastal zone and habitat declines as a result of development and sea level rise. Balancing public access and the needs of shorebirds will be imperative moving forward, as management of human use has the potential to greatly affect shorebird use, distribution, and demography.

To assess the effects of human disturbance on five focal species (American Oystercatchers [*Haematopus palliates*], Piping Plovers [*Charadrius melodus*], Red Knots [*Calidris canutus*], Semipalmated Sandpipers [*Calidris pusilla*], and Wilson's Plovers [*Charadrius wilsonia*]) throughout the annual cycle, we developed a standardized protocol to collect data on potential disturbance types, shorebird distribution and abundance, shorebird behavior, breeding productivity, and management activities. We collected data at sites along the Atlantic Flyway that support breeding and non-breeding focal species, have different types and levels of human disturbance, and employ various human disturbance management techniques. The goals of this project were to:

1) develop a standardized protocol to measure potential disturbances and their effects on shorebirds,
2) establish the distribution and frequency of a suite of potential disturbances and disturbance mitigating measures during all seasons on the Atlantic Flyway,
3) assess the effects of these potential disturbances and management actions on the distribution and abundance of shorebirds and
4) shorebird behavior, and
5) to use these findings to help inform a concurrent effort to use Community Based Social Marketing to ameliorate disturbance on the Atlantic Coast.

# METHODS

## Protocol development

Beginning in October 2017, we worked with partners throughout the Atlantic Flyway, from Nova Scotia to Florida, to develop a standardized protocol for data collection to evaluate the effects of human disturbance on shorebirds. We partly based the data collection protocol on previous disturbance work with Semipalmated Sandpipers in the Bay of Fundy as part of the 'Space to Roost' project (CEC 2017) and work conducted on shorebirds and disturbance during fall migration at USFWS refuges in the Northeast (Mengak et al. 2018). Following the initial development of the protocol, datasheets, and database, we had extensive discussions with partners before producing a final draft of the protocol and data collection materials. We focused on four types of data collection to provide information on the effect of potential human disturbance on the five focal species:

**1. Point counts:** Point counts served as the linkage between the frequency of human disturbance and shorebird demography and habitat use. By collecting human and shorebird use data simultaneously in specified locations, we can determine whether human activities directly impact fine-scale shorebird habitat use, as well as local patterns in shorebird abundance.

**2. Behavioral samples:** Behavior data collected alongside point count data provided us with the opportunity to identify and understand the ecological mechanisms (e.g., altered feeding or resting regimes, habitat avoidance, etc.) linking human disturbance and shorebird population dynamics, which will better guide management decisions.

**3. Productivity information:** Reproductive activity and success data provided an opportunity to determine indirect associations between human use of shorelines and local production. In relation to ongoing management actions and human disturbances, this also will allow us to determine the effectiveness of various management regulations on relative shorebird production.

**4. Site information:** Site information was used to classify the types and levels of human disturbances that are unique to a given site and to identify the similarities in experienced disturbance shared among monitored sites. This information will be used to identify the types of disturbances that may influence shorebird behavior and demography and will inform management objectives.

## Study area

We collected data at 35 sites from Nova Scotia to Florida from November 2017–October 2018 (Table 1). We divided the year up into ‘seasons’ based on annual cycle of shorebirds, which resulted in winter, spring migration, breeding season, and fall migration. As sites in this study represented a range of latitudes, the dates for each season varied depending on location and were decided on in consultation with the partners familiar with each site.

**Table 1.** A summary of the number of sites along the Atlantic Flyway that participated in this study each season, from November 2017–October 2018.

| | Winter | Spring migration | Breeding season[a] | Fall migration[a] |
|---|---|---|---|---|
| **Florida** | 4 | 4 | 3 | 4 |
| **South Carolina** | - | 2 | 5 | 2 |
| **North Carolina** | 3 | 4 | 4 | 4 |
| **New York** | - | 3 | 3 | 3 |
| **Connecticut** | - | 6 | 6 | 6 |
| **Maine** | - | - | 1 | 4 |
| **Nova Scotia** | - | - | 4 | 3 |
| **Total** | **7** | **19** | **26** | **26** |

[a] The number of sites is subject to change, as we are still receiving breeding season data and fall migration data collection is ongoing.

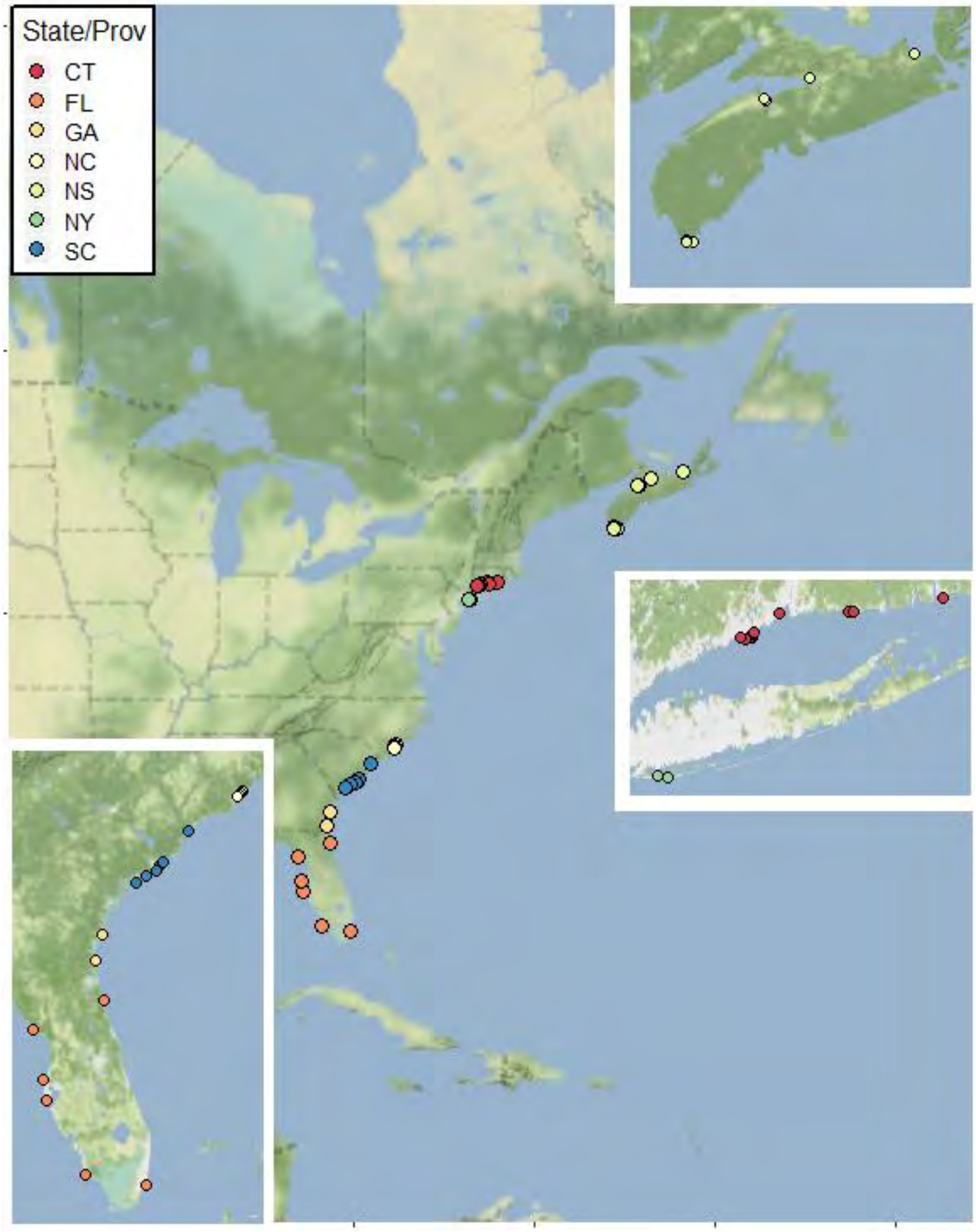


**Figure 1.** A map of participating sites that have provided shorebird abundance and disturbance data. Colors indicate the state or province a particular site is located. Inset maps provide a more detailed views of Nova Scotia (top right), New York and Connecticut (center right), and North Carolina, South Carolina, Georgia, and Florida (bottom left).

## Field methods

We chose sites with varying levels of potential disturbance types and shorebird abundance. Once sites were selected, we chose fixed points at each site, that were at least 400 m apart, where point counts and behavioral samples were performed every 1–2 weeks.

We recorded the time we arrived, the time of the first high tide that day, the temperature (°C), and the windspeed (km/hr) when entering the site at each survey. We then navigated to each point where we performed a point count followed immediately by one or more behavioral samples. When we arrived at the point, we waited 3 minutes to mitigate any potential observer disturbance and then performed a point count. Each point count consisted of counting all focal species and potential disturbance types (vehicles, boats, aerial disturbance, leashed dogs, unleashed dogs, people moving, people at rest, and predators) found within a 200 m radius of the observer. In addition, we recorded whether any of the 200 m radius fell within a closed area, including symbolic fencing or a larger area closed to the public.

If during the point count, any of the focal species were located within the 200 m, we then performed 3-minute behavioral samples on one of each of the species immediately following the point count. During the 3-minute behavioral samples, we recorded the instantaneous behavior (mobile, alert, resting, foraging, flying, and out of site) of the individual every 10 seconds. We chose individuals for the behavioral samples randomly, such that if they were in a flock, we chose one near the center of the flock. If an individual left the area during the behavioral sample, we chose another individual if one was present. When we finished each survey, we recorded the time we left the site, the temperature (°C), and windspeed (km/hr).

During the breeding season we recorded productivity information for focal species nesting at each site. The productivity information focused on nest and brood success, if known. In addition to nest and brood productivity information, we also collected information regarding potential disturbance management techniques, including whether or not each nest was surrounded by symbolic fencing. Due to concerns regarding observer disturbance to nesting focal species as well as other beach-nesting species, behavioral samples were not performed or were performed at a much-reduced frequency during the breeding season.

In addition, we collected broad-scale, site level information. We recorded information about the site location and size, as well as landowner and manager information. We also recorded information that may influence potential disturbance at the site, including the number of pedestrian and vehicle access points, the nearest parking lot or boat ramp (km), whether or not dogs were allowed on the beach, and if beach raking, beach modifications, or major events occurred at the site. Finally, we recorded information on potential disturbance management at each site, including whether or not part or all of the site was open to vehicles and/or pedestrians, whether symbolic fencing was used, and if there were signs, monitors, and law enforcement at the site. For standard operating procedures and datasheets used during this study, please see Appendix A.

## Analytical methods

We were primarily interested in 1) describing patterns in potential disturbance across space and time; 2) linking the observed variation in potential disturbance with shorebird abundance; and 3) investigating, conditioned on the presence of shorebirds, whether shorebird behavior was further influenced by nearby potential disturbances.

*Description of potential anthropogenic disturbance*

For this report, we calculated the Pearson correlation scores among various site-level descriptors generated from the Site Information database to establish the potential associations among disturbance types, environmental conditions, and management strategies or constraints. Next, we investigated the observed variance 1) between the winter and spring survey efforts and 2) across all surveyed sites, for of two of the critical types of disturbance, presence of dogs and the abundance of people. Additionally, we assessed the variation in the relative amount of area closed to the public between the winter and spring survey periods and across all surveyed sites. Prior to model building, we investigated the potential for associations between disturbance and shorebirds by plotting the observed numbers of shorebirds against the number of people or dogs present, in addition to whether the site was open or closed to the public. When necessary, we used linear models to determine support for differences among specified groups.

*Association between potential disturbance and shorebird abundance*

We determined the extent to and mechanism by which potential disturbances influenced shorebird abundance by using zero-inflated (ZIP) Poisson regression, which provides a formal approach to account for excess zero counts in data. Excess zeros, or overdispersion, often can result in poor model fit in Poisson regressions, specifically if the occurrence of a zero is related to multiple sources of variability. With these data, we expected that zero counts of shorebirds could be observed as a function of a structural zero count (e.g., a species is always absent from a point due to species-specific habitat preferences), or a sampling zero count (e.g., a species is sometimes absent from a point due to variation in habitat use or detectability). Thus, ZIP models account for these competing sources of variability in absence, and more importantly, provide a mechanism to test for the associations between various potential disturbances and 1) species presence at each point and 2) abundance, conditioned on species presence, during each survey.

$$1: y_a = pois(\lambda_a \times (1 - z_a))$$

For each species, we constructed a model [1] where the outcome (e.g., observation or lack thereof of a shorebird) of each point count $(y_a)$ was a function of whether that point was a structural or sampling absence of a particular shorebird $(z_a)$ [2] and, given that it was not a structural absence, the realization of a Poisson log-linear model $(\log(\lambda_a))$ [3].

$$2: z_a = bern(ilogit(\beta z_{site} + \beta z_{x,d}A_d + \varepsilon z_p))$$

First, we allowed, $z_a$, or the structural absence of observations from a particular point, to vary as function of a random effect of site $(\beta z_{site})$ and point $(\varepsilon z_p)$. Next, we used explanatory variables describing the numbers of people observed, whether dogs were present of absent, and whether the point was partially closed or completely open the public to determine whether anthropogenic activities were associated with the presence or absence of shorebirds. We then accounted for unobservable variation in $y_a$, or the distribution of observations that were not structural absences [3], by including random effects of for each site $(\beta_{site})$ and point $(\varepsilon_p)$. We also allowed $y_a$ to vary as a function of quadratic relationships $(\beta_{x,1};\ \beta_{x,2})$ between a series of environmental variables ($c$): 1) wind speed (km/h) at the start of a survey; 2) time of day; and 3) the relative time (minutes) until high tide, in which -5 would indicate 5 minutes until high tide, and 5 would indicate 5 minutes since high tide. Finally, after accounting for these sources of heterogeneity in counts, we determined whether any of the residual variation in $y_a$, was related to potential disturbances or management efforts $(\beta_{x,d})$, which include the number of people observed, the presence of dogs, or whether a particular point was partially closed or completely open to the public.

$$3: \log(\lambda_a) = \beta_{site} + \beta_{x,1}A_c + \beta_{x,2}A_x^2 + \beta_{x,d}A_d + \varepsilon_p$$

Together, this approach allowed us to determine not only if a potential disturbance was associated with local abundance, but also whether human disturbance influenced local shorebird abundance by 1) completely excluding birds from the area or 2) if birds continued to occupy disturbed areas, but in lower abundances.

For this analysis, we only included point counts that occurred within the seasonal range limits for each species. We reduced model runtime by building independent models for each species that we determined to have a sufficient number of observations (AMOY, PIPL, REKN, and WIPL). We specified each model within R (R Core Team 2012) with the package jagsUI to call JAGS (Plummer 2003). For each model, we ran three chains of 175,000 iterations (thin = 2) with adapt and burn-in periods of 175,000 and 75,000 iterations, respectively. We interpret support for associations between disturbance variables and species presence and abundance through whether the distribution of the posterior of a particular parameter was separate from zero.

*Association between potential disturbance and shorebird behavior*

We determined the association between the species behavior and the extent of current, nearby potential disturbances with a multinomial regression, which estimated the proportion of each activity budget (i.e., the total number of observations (max = 18) of an 'individual' during a behavioral survey) that was spent 1) being alert; 2) foraging; 3) moving; or 4) resting. We then used models to determine the extent to which the relative amount of time an individual was classified as particular behavior was associated with 1) species; 2) environmental conditions (e.g., time of day, temperature, wind speed; and relative time until high tide); 4) season (i.e., winter or spring); and 5) random variation at the survey level. Simply, multinomial regression is an expanded parameterization of a logistic regression model, which allows for inference to be drawn between a single dependent variable and one (logistic regression) or more (multinomial regression) independent variables. Much like in habitat use models analyzed in a logistic regression framework, in which the likelihood of habitat use is relative to likelihood that habitat was not used, multinomial models constrain inference to be relative to a single category, or in our case behavioral state. Thus, we constrained inference as the likelihood of the three independent behaviors (i.e., Alert, Foraging, or Moving) being observed relative to a reference behavior, Resting. From an analytical perspective, the assignment of a particular group as the reference category does not affect inference, however, certain pairwise comparisons are more inferentially meaningful. For example, directly comparing the amount of time spent moving versus foraging may not be important, whereas directly comparing the amount of time spent being alert versus resting may be more important.

For this analysis, we only included species in which a sufficient number of behavioral surveys were included across disturbed and less disturbed habitats, which included AMOY, PIPL, and WIPL. We specified each model within R (R Core Team 2012) with the package jagsUI to call JAGS (Plummer 2003). For each model, we ran three chains of 175,000 iterations (thin = 2) with adapt and burn-in periods of 175,000 and 75,000 iterations, respectively. We interpret support for associations between disturbance variables and species-specific behaviors through whether the distribution of the posterior of a particular parameter was separate from zero.

*Ranking sites for management priority*

We also demonstrate an approach to preferentially rank sites using metrics of local shorebird abundance derived from model predictions to allow ecological models to inform management objectives. We used the site-specific intercepts of the presence ($\beta z_{site}$) and abundance ($\beta_{site}$) for each species to estimate the average number of individuals observed at each site. For each species, we z-standardized these site-specific abundances, which resulted in sites that hosted fewer than the average number of individuals being assigned negative values and sites that hosted more than the average number of individuals being assigned positive values. Sites that were outside the season ranges for a particular species were assigned a zero for that species. Lastly, we summed across species for each site to develop a shorebird community score for all sites monitored. For this report, we only considered data from the spring migration surveys, and arbitrarily set the extent of the priority ranking to include the seven sites that had the lowest shorebird community score for illustration. We summarized site-specific disturbances describing human and dog behaviors to highlight potential action areas.

# RESULTS

*Summary of data collection to date*

Although data collection and reporting are not entirely finished, participants collected nearly 3,000 point counts, over 700 behavioral samples, and monitored over 200 nests in 8 states and provinces since the inception of this project (Table 2). Surveys to date have encompassed over 230km of shorebird habitat (Table 3).

**Table 2.** Point counts and behavioral samples collected each season at 209 fixed points along the Atlantic Flyway from November 2017–October 2018, as well as nests monitored during the breeding season.

| | Winter | Spring migration | Breeding season[a] | Fall migration[a] | **Total** |
|---|---|---|---|---|---|
| **Point counts** | 352 | 857 | 1779 | 190 | **3178** |
| **Behavioral samples** | 153 | 391 | 117[b] | 130 | **791** |
| **Nests monitored** | - | - | 239 | - | **239** |

[a] The number of samples is subject to change, as we are still receiving breeding season data and fall migration data collection is ongoing.
[b] Due to potential observer disturbance to nesting focal species and other beach nesting species, behavioral samples were performed less frequently during the breeding season.

**Table 3.** Kilometers of habitat surveyed for potential disturbances and their effects on shorebird abundance and behavior along the Atlantic Flyway during data collection from November 2017–October 2018.

| | Winter | Spring migration | Breeding season[a] | Fall migration[a] | **Total** |
|---|---|---|---|---|---|
| **Kilometers surveyed** | 69 | 34 | 85 | 46 | **234** |

[a] Kilometers of habitat surveyed is subject to change, as we are still receiving breeding season data and fall migration data collection is ongoing.

*Patterns in use and management of sites within study system*

We identified patterns in site use and management strategies by investigating how correlated various site-level characateristics were to each other (Fig. 2). Pairwise associations coded in darker blues suggest a positive association between the two characteristics, whereas pairwise associations coded in red suggest a negative associaiton. For example, sites that raked their beach were more likely to have events on site and had more access points for pedestrians, but were less likely to formally record compliance issues (e.g., off leash dogs in leash-only areas) and had parking areas closer to the beach. Although we would caution against infering causation from these data or directly linking various site descriptors together, the observed associations provide insight into the complexities surrounding the types and magntitude of potential antrhopogenic disturbance on our coastlines.

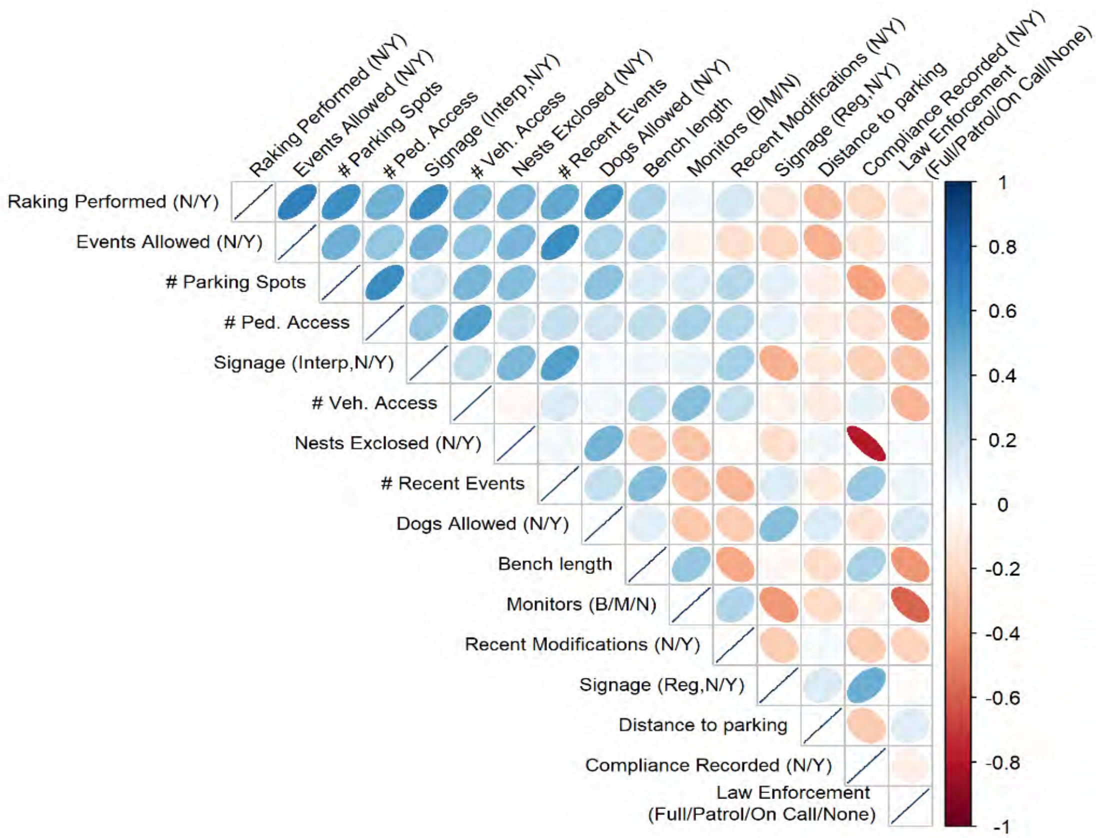


**Figure 2.** Correlations among anthropogenic use and management protocols for monitored sites. Blues suggest positive associations, and reds suggest negative associations. The order of the levels for variables described as categorical factors are listed in order of the variable name (e.g., N/Y means No is the lowest value and Yes is the highest value).

*Variation in potential disturbance throughout the study system*

We found substantial variation among surveyed sites within the study system in regards to the amount of area potentially protected (Fig. 3A) for shorebirds, as well as the magnitude of key potential disturbances, such dogs (Fig. 3B) and people (Fig. 3C) that shorebirds would experience. This result suggests that the selection of study sites was successful in collecting survey data across a range of possible disturbance and management regimes, which will provide insight into the average conditions along the Atlantic coast and provide an opportunity to directly test the behavioral and demographic consequences of these sources of environmental variability. Although the spread of observed disturbances was larger during the spring versus the winter, there was no evidence that the average number of people ($\bar{x}_{winter} = 3.32$ $[sd = 3.18]$, $\bar{x}_{spring} = 5.17$ $[sd = 6.89]$) or dogs ($\bar{x}_{fall} = 0.12$ $[sd = 0.13]$, $\bar{x}_{spring} = 0.22$ $[sd = 0.23]$) near each point was substantially different during these two seasons. Likewise, there was no evidence that sites monitored during the winter ($\bar{x}_{winter} = 0.06$ $[sd = 0.07]$) had more or less protected areas than sites

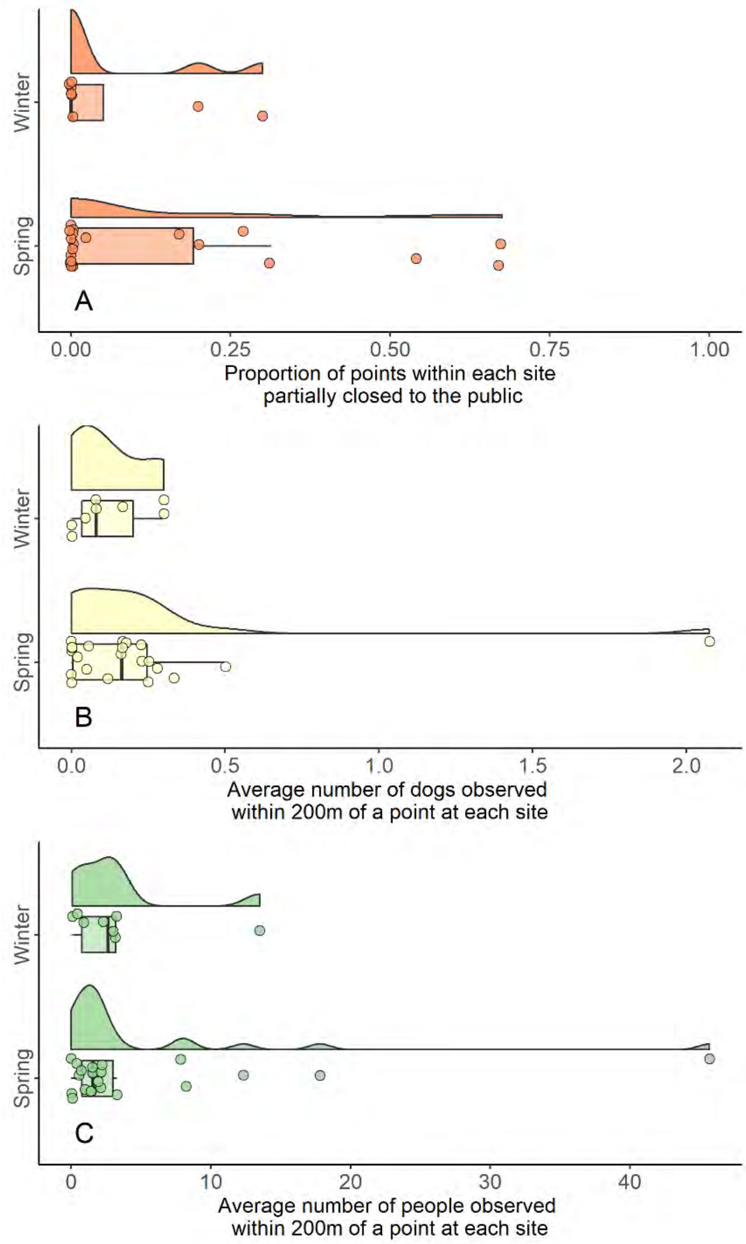


**Figure 3.** A) The proportion (scatter plot) and distribution of proportion closed (bar, violin plots) of all points within each site that were at least partially closed to the public, and the average number (scatter plots) and distribution of averages (bar, violin plots) of B) dogs, and C) people observed at each site during the winter and spring survey efforts.

monitored during the spring ($\bar{x}_{spring} = 0.13$ [$sd = 0.15$]). Of note, the proportion of point counts that included at least one leashed or off-leash dog were similar ($\bar{x}_{leashed}$= 0.05 vs. $\bar{x}_{off-leash}$= 0.07), but indicate the potential to target behaviors not in alignment with management objectives.

*Associations among human abundance, dogs, and beach closures*

On average, we found that points within 200m of an area specified to be closed to the public were associated with fewer people ($\bar{x}_{closed} = -2.86$ [$sd = 1.18$]), suggesting that site closures, to an extent, were effective at reducing the number of people that access an area. However, closures were not perfect barriers, as a substantial number of surveys, in or near closed areas, observed both humans and dogs nearby (Fig. 4).

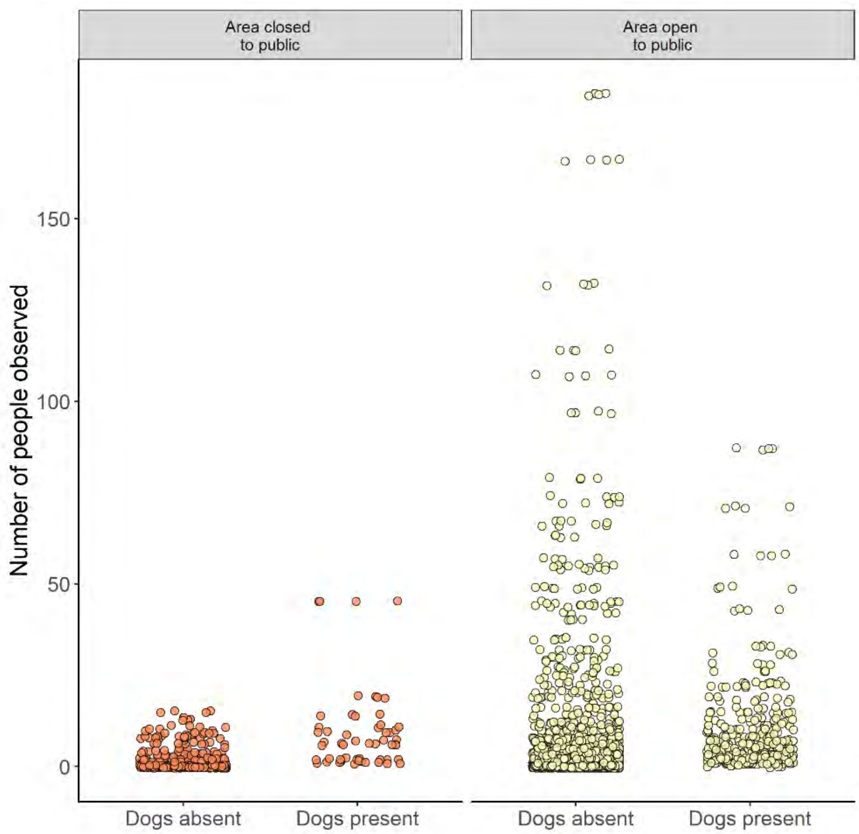


**Figure 4.** Number of people observed within 200m of each point relative to whether that point occurred within an area closed (left panel) or open (right panel) to the public and whether dogs were also absent or present from that survey.

*Patterns in shorebird abundance between areas open and closed to public*

We found inconsistent patterns between shorebird abundance and whether or not a point was partially closed or completely open to the public. For all species, the majority of point counts were recorded as absences, regardless of whether the point was open or closed to the public. For both AMOY and PIPL, the most numerous point counts occurred in areas open to the public, however, for REKN and WIPL, the most numerous point counts occurred in areas closed to the public. Together, these results highlight the potential for species-specific impacts of, and tolerances for, potential disturbances.

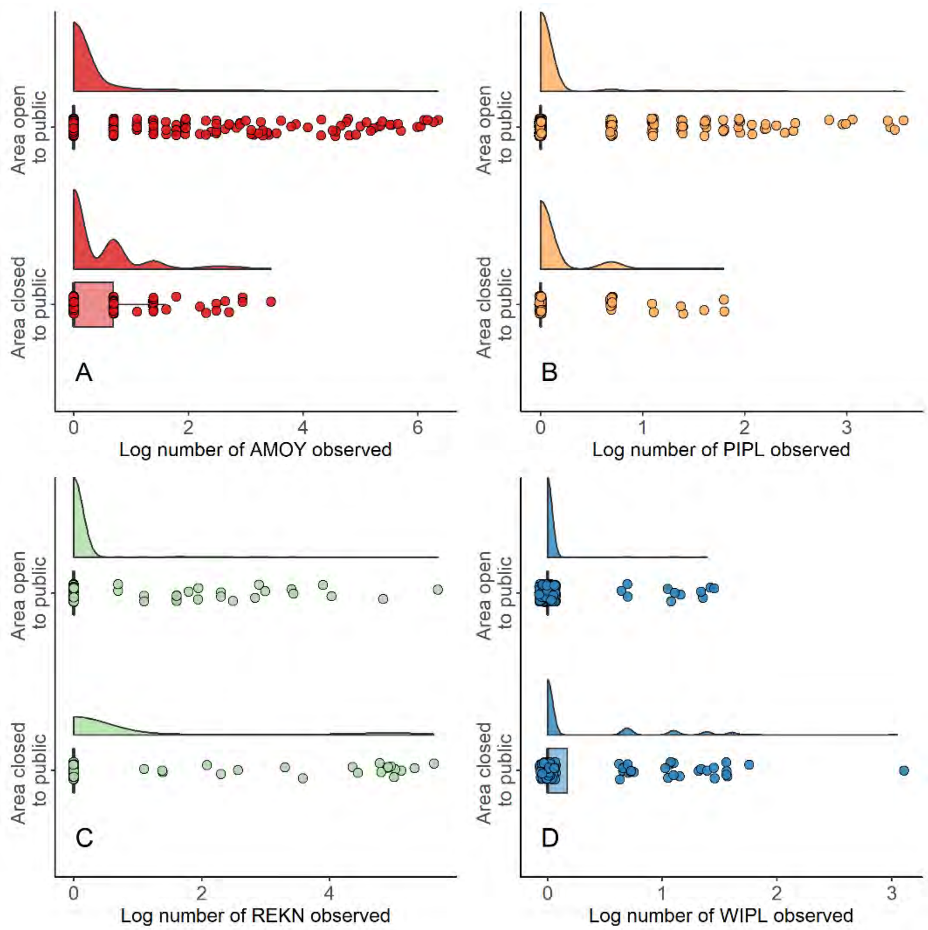


**Figure 5.** The observed number (log-scale) of A) American oystercatchers, B) piping plovers, C) red knots, and D) Wilson's plovers observed within 200m of a point related to whether a portion of the surveyed area fell within an area that was closed or open to the public.

*Association between the abundance of people and shorebirds*

We found a consistent pattern that suggested negative associations among the number of people and the numbers of four species of shorebirds (AMOY, PIPL, REKN, and WIPL) observed within 200m of a point. Although variable among the species, shorebirds were rarely observed near an area if there were over 15 people within 200m. For all species, the point counts with the largest numbers of shorebirds were generally associated with areas where the observers were the only humans nearby.

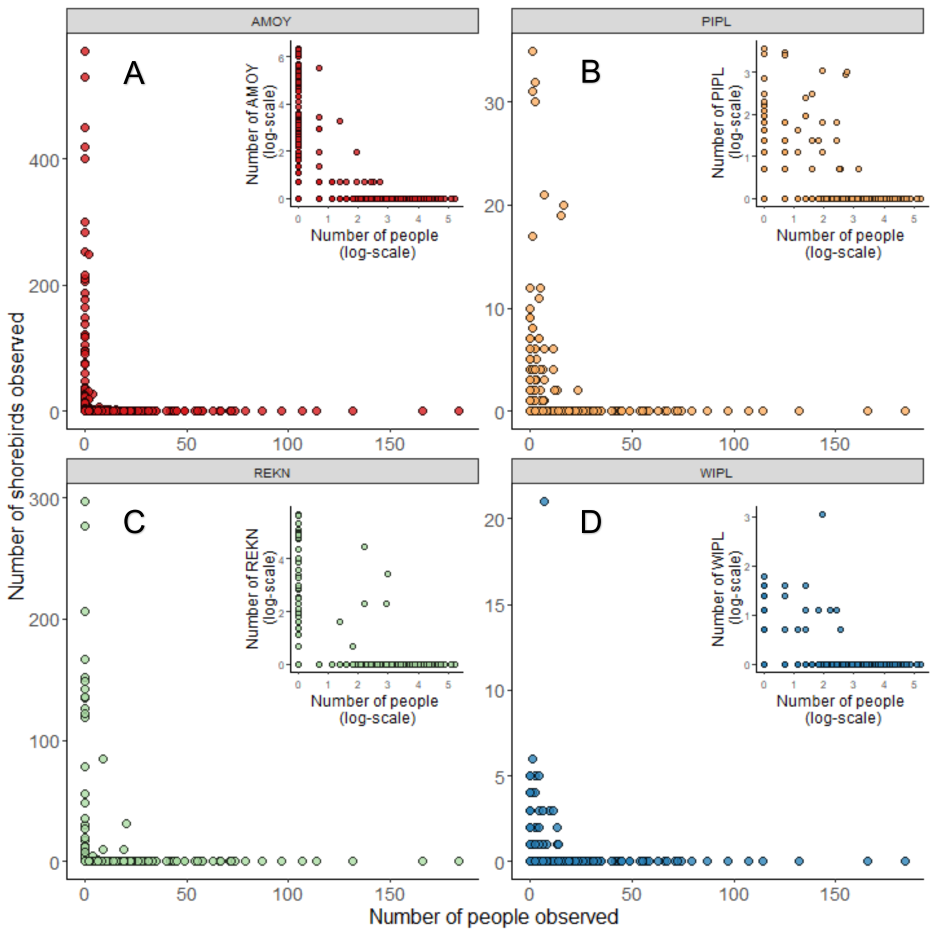


**Figure 6.** The association between people observed within 200m of a point and the number of A) American oystercatchers, B) piping plovers, C) red knots, and D) Wilson's plovers observed within 200 m. Inset figures represent the same data but both the counts of people and shorebirds were presented on the log-scale to assist with pattern visualization.

*Association between dogs and shorebird abundance*
Similar to the observed association between humans and shorebird abundance, we found a consistent pattern across all species, which suggested that in surveys that observed dogs nearby also were substantially less likely to observe shorebirds within 200m.

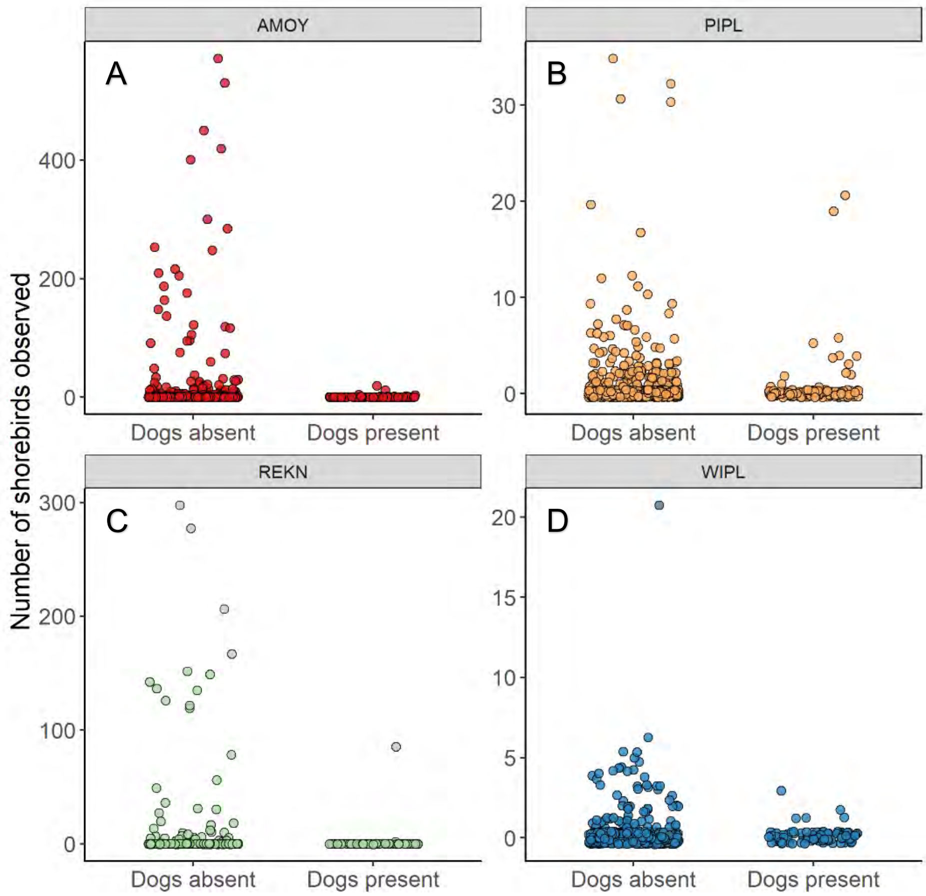


**Figure 7.** Observations of A) American oystercatchers, B) piping plovers, C) red knots, and D) Wilson's plovers observed within 200m of a point related to whether at least one dog was observed (Dogs present) or not (Dogs absent) within the survey point.

*Determining the mechanistic relationships between potential disturbance and shorebird abundance*

The most consistently supported relationship across species linking potential disturbance with the observed abundance of shorebirds at a point was whether the point was partially closed or open to the public (Fig. 8). All species were more likely to be present at closed sites relative to open sites, and, conditioned on presence, three species (AMOY, REKN, and WIPL) were observed in greater abundance in areas closed to the public, relative to areas that were open. Support for direct links between the

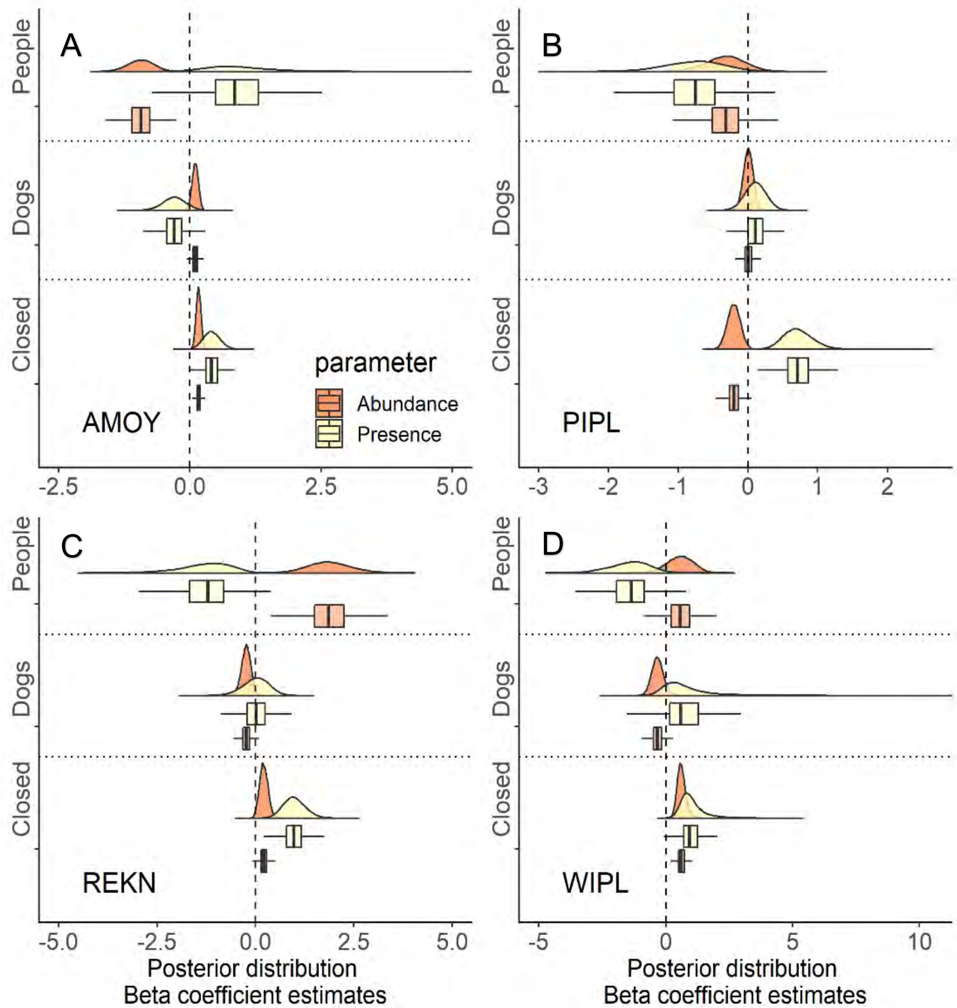


**Figure 8.** The posterior distributions from a zero-inflated Poisson regression model that describe the effects of 1) the number of people present within 200m; 2) whether any dogs were present within 200m; 3) or whether a portion of the 200m area was closed to the public on A) American oystercatcher, B) piping plover, C) red knot, or D) Wilson's plover presence (cream) or abundance (tangerine). Values right of the dashed line indicate a positive association between an environmental characteristic and presence or abundance, values on the left of the dashed line indicate a negative association between presence or abundance.

number of people or the presence of dogs and shorebird presence or abundance was less consistent across species. However, given that closed areas in general were associated with fewer dogs, people, and other disturbances (Fig. 4), we suspect that reduced anthropogenic disturbance is a key factor for habitats that occur within or near areas closed to the public.

Another way of viewing this issue is to model human abundance as a function of similar explanatory variables (Fig. 9). The positive association between the presence of dogs and human abundance highlights the fundamental confounding between these two sources of disturbance, which is that dogs occur on beaches because humans choose to bring them. This finding also suggests that issues related to dogs on beaches is more of a human problem, as opposed to an issue of dogs, themselves. One point of interest is the lack of a clear negative association between closures and human presence or abundance, suggesting that being near closed portions of beaches may be attractive to people. In fact, if present, people were predicted to be more abundant near closed areas relative to areas fully open to the public. Although unconventional, inference from this model of human abundance contains valuable information. For example, the negative association between human abundance and both the abundance of REKN and PIPL indicate that through either shorebird behavior, habitat partitioning, or management strategies, humans and these shorebirds maintain some degree of separation.

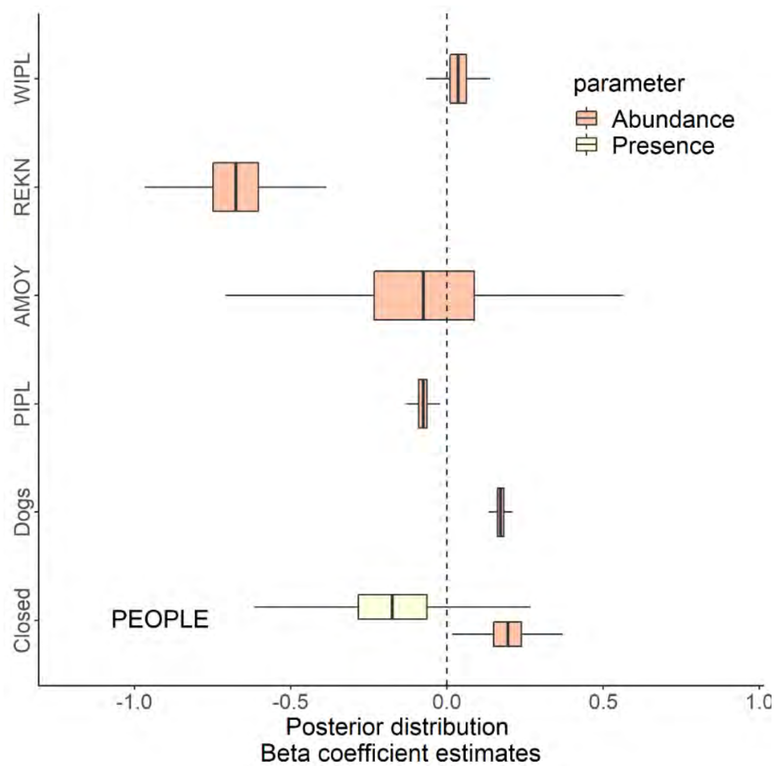


**Figure 9.** The posterior distributions from a zero-inflated Poisson regression model that describe the effects of the number of shorebirds (WIPL, REKN, AMOY, AND PIPL) or the presence of dogs within 200m, and whether an area is closed to the public on presence (cream) or abundance (tangerine) of people within 200m.

*Determining the mechanistic relationships between disturbance and shorebird behaviors*

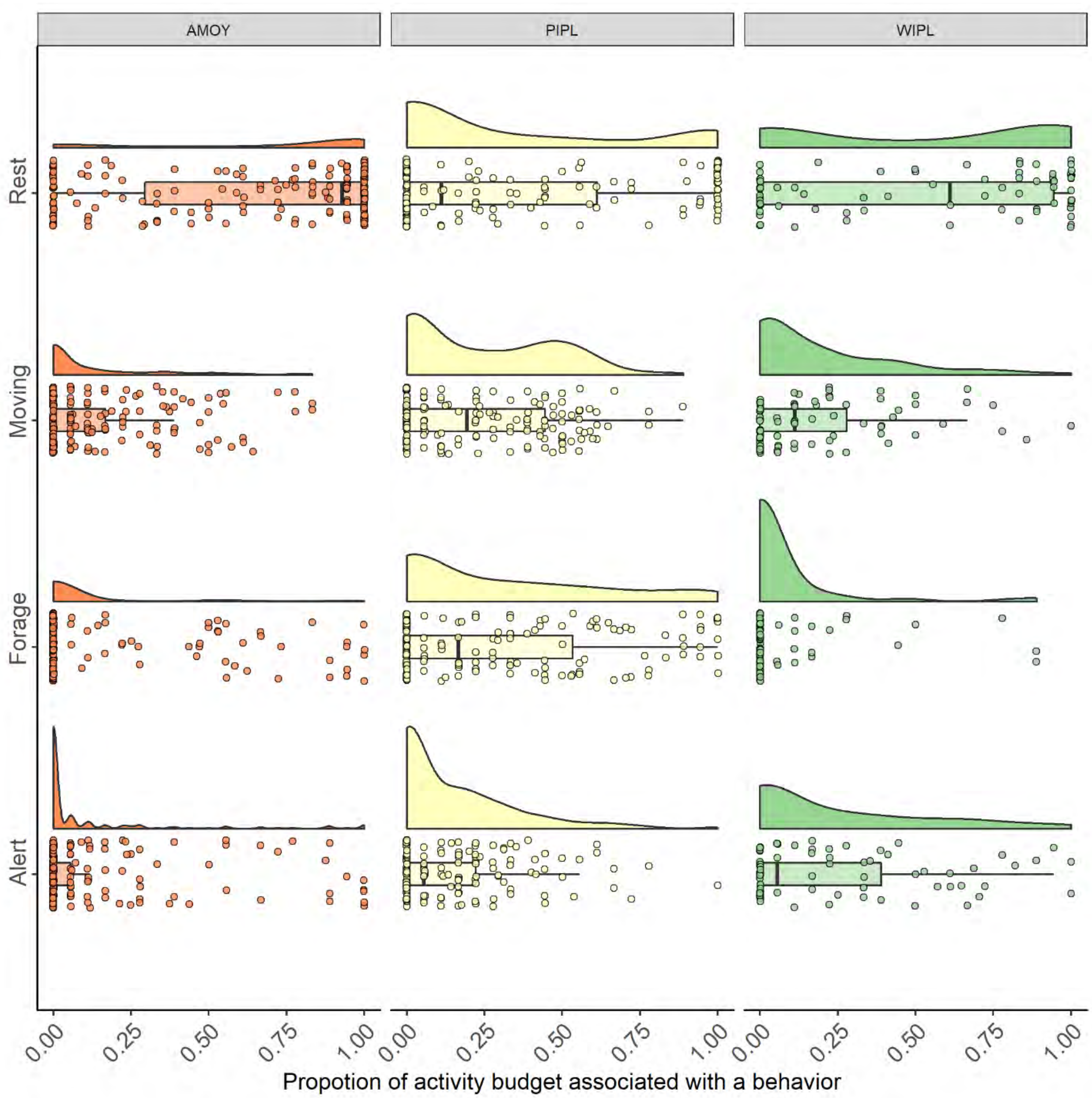


**Figure 10.** The proportion of each activity budget (scatter plots) and among survey variability in activity budget profiles (boxplot and violin plots) associated with specific behaviors (Resting, Moving, Foraging, or Alert) for American oystercatchers (AMOY), piping plovers (PIPL), and Wilson's plover (WIPL) during the winter and spring behavioral samples.

For the three species currently with a sufficient number of behavioral samples completed to draw inferences from, we found that piping plovers were most likely to be observed foraging or moving, but the least likely to be observed resting (Fig. 10). American oystercatchers and Wilson's plovers were predominantly observed resting. However, all three species were classified as being alert in a similar proportion of the surveys.

American oystercatchers were more likely to be alert or moving than resting when dogs or people were present (Fig. 11). They also were less likely to be foraging than resting when found in areas closed to the public, which suggests that AMOY may be using these areas closed to the public primarily for roosting.

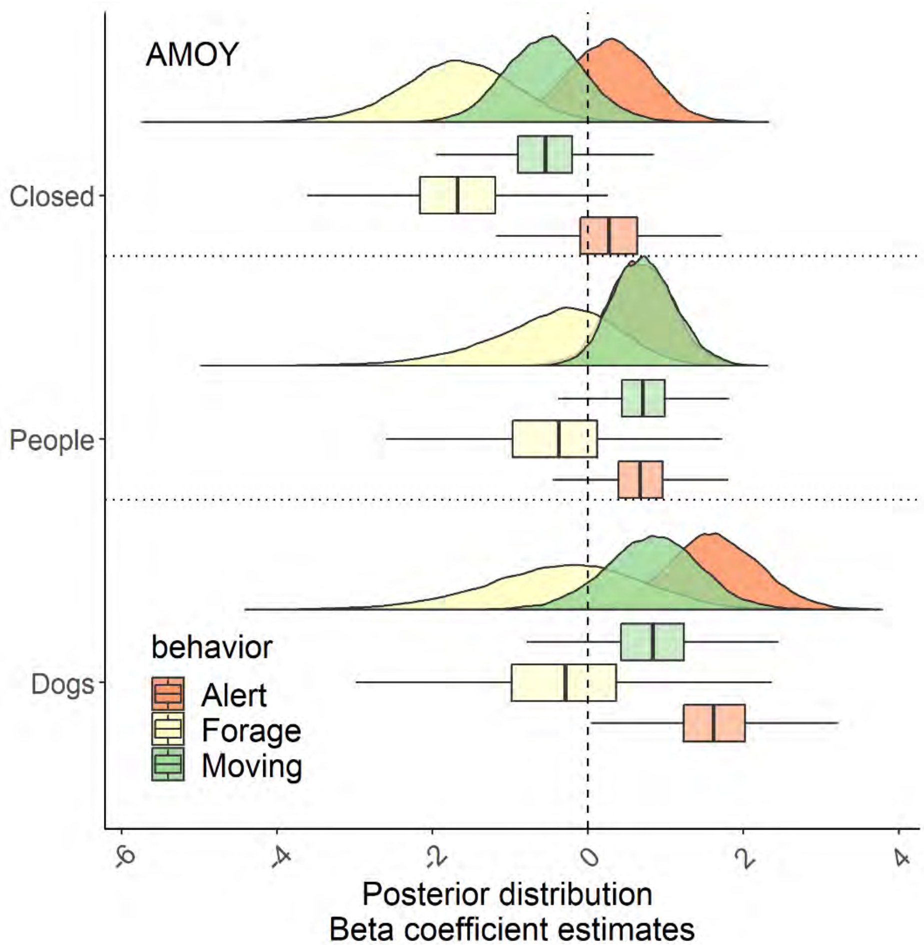


**Figure 11**. The posterior distribution describing the influence of whether 1) an area was closed to the public; 2) the number of people or; 3) dogs were present on the likelihood an American oystercatcher would be alert, foraging, or moving relative to resting. Values left or right of the dashed line indicate a behavior is less or more likely, respectively, as function of an environmental feature or disturbance.

We also found that piping plovers exhibited a different behavioral profile in areas closed to the public (Fig. 12). Similar to AMOY, PIPL were more likely to be resting relative to being alert, foraging, or moving in areas closed to the public. PIPL also were more likely to be alert than resting when dogs were present. Interestingly, PIPL also were more likely to be foraging than resting whenever dogs and people were present.

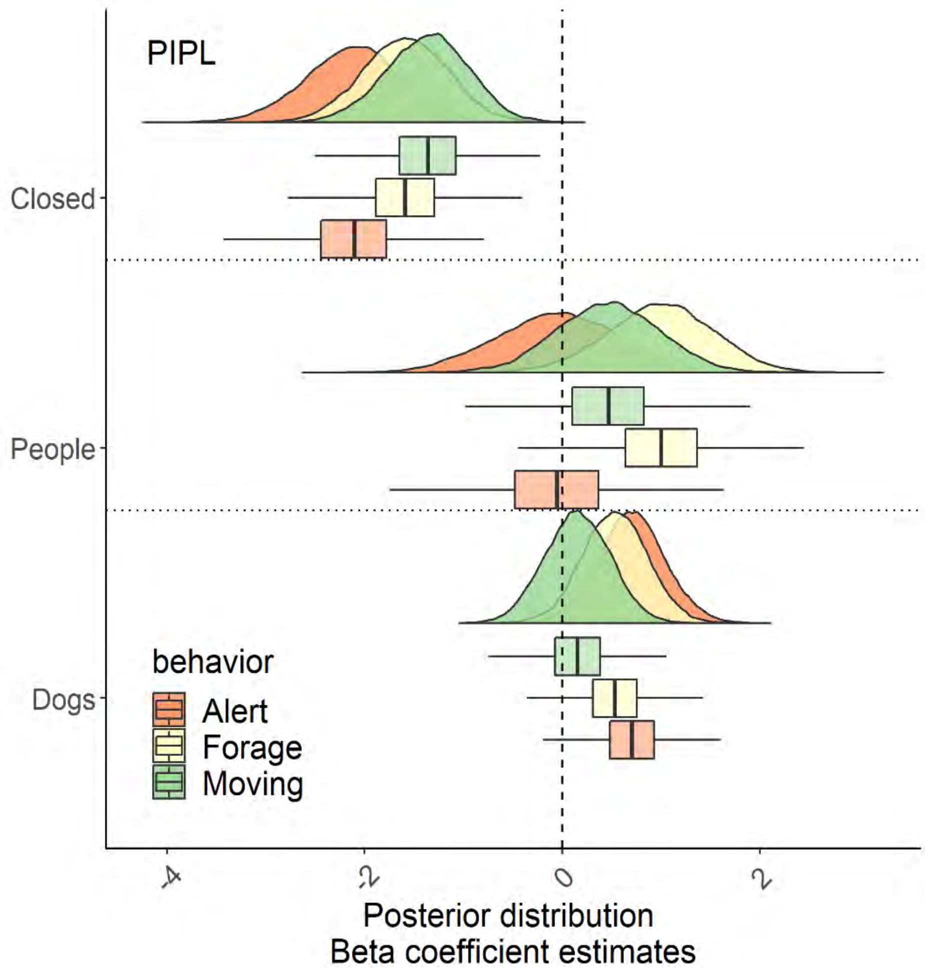


**Figure 12**. The posterior distribution describing the influence of whether 1) an area was closed to the public; 2) the number of people or; 3) dogs were present on the likelihood a piping plover would be alert, foraging, or moving relative to resting. Values left or right of the dashed line indicate a behavior is less or more likely, respectively, as function of an environmental feature or disturbance.

Lastly, we found less support for meaningful associations between disturbance and WIPL behavior (Fig. 13), which may be related to the substantially fewer behavioral observations that were completed on WIPL than AMOY and PIPL.

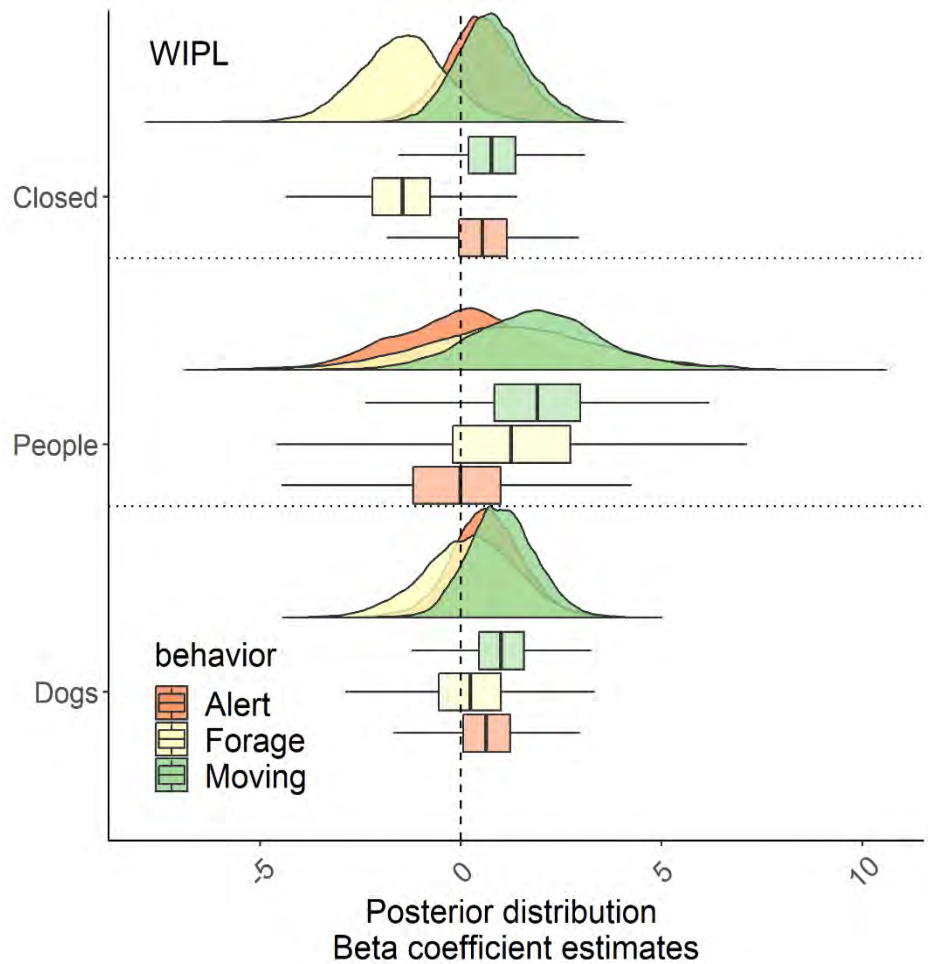


**Figure 13.** The posterior distribution describing the influence of whether 1) an area was closed to the public; 2) the number of people or; 3) dogs were present on the likelihood a Wilson's plover would be alert, foraging, or moving relative to resting. Values left or right of the dashed line indicate a behavior is less or more likely, respectively, as function of an environmental feature or disturbance.

*Prioritizing sites for management action*

We ranked sites in terms of relative ‘underperformance’ from predicted abundance of shorebirds during the spring migration (Table 3). These sites included three from North Carolina (North Figure Eight Island, North Wrightsville Beach, and South Topsail Island), two from Connecticut (Bluff Point and Milford Shoreline), and one site each from South Carolina (Sullivan’s Island) and Florida (Crandon State Park). Although these sites vary in the underlying ecological importance for our suite of shorebirds, and some sites are beyond the geographical ranges for certain species, there were similarities in potential disturbances across many of these priority sites. For example, off-leash dogs were only permitted at a single site, however, off-leash dogs were observed at six out of seven sites. Importantly, observations of off-leash dogs were equal to or greater than the observations of leashed dogs at four out of six sites where dogs were observed. The number of dogs observed at Sullivan’s Island, SC is striking as it was an order of magnitude greater than any site within the study, despite the fact that dogs were not allowed at this site. Observations of leashed and off-leash dogs at some of these sites suggest that compliance to local rules is not complete, and these sites are areas where opportunities exist to alter behaviors that may negatively impact the conservation of shorebirds.

**Table 3.** Summary of the potential (N = 7) priority sites for management action during spring migration. Selection of priority sites was based on model predictions of site-specific patterns in shorebird metrics, which suggested that these areas generally underperformed predictions in either overall shorebird presence or abundance. Each site is presented with summaries of management constraints (Dogs Allowed and Parking Capacity) and observed disturbances, such as the occurrence (i.e., the proportion of points surveyed in which a disturbance-type was observed) of leashed and off-leash dogs and mobile and resting people, the number (i.e., total number observed across all points and surveyed) of leashed and off-leash dogs and mobile and resting people, as well as the percent of dogs observed that were off-leash and the percent of people that were mobile.

| State | Site | Dogs Allowed | Occurrence: Leashed Dogs | Occurrence: Off-leash Dogs | Number: Leashed Dogs | Number: Off-leashed Dogs | Percent of Dogs Off-leash |
|---|---|---|---|---|---|---|---|
| **FL** | Crandon Pk | No | 0.10 | 0.03 | 4 | 1 | 20.00 |
| **SC** | Sullivan's Island | Allowed | 0.26 | 0.56 | 33 | 135 | 80.36 |
| **NC** | South Topsail Island | Allowed | 0.05 | 0.10 | 10 | 10 | 50.00 |
| **NC** | North Figure Eight | Leashed-only | 0.00 | 0.13 | 0 | 12 | 100.00 |
| **CT** | Bluff Point | Leashed-only | 0.00 | 0.00 | 0 | 0 | 0.00 |
| **NC** | North Wrightsville Beach | Leashed-only | 0.13 | 0.05 | 7 | 2 | 22.22 |
| **CT** | Housatonic: Milford Shoreline | Leashed-only | 0.08 | 0.17 | 1 | 2 | 66.67 |

| State | Site | Parking Capacity | Occurrence: Mobile People | Occurrence: Resting People | Number: Mobile People | Number: Resting People | Percent of People Moving |
|---|---|---|---|---|---|---|---|
| **FL** | Crandon Pk | 3080 | 1.00 | 0.52 | 384 | 168 | 69.57 |
| **SC** | Sullivan's Island | 112 | 0.86 | 0.35 | 422 | 212 | 66.56 |
| **NC** | South Topsail Island | 90 | 0.44 | 0.14 | 111 | 65 | 63.07 |
| **NC** | North Figure Eight | 84 | 0.36 | 0.12 | 106 | 37 | 74.13 |
| **CT** | Bluff Point | 120 | 0.10 | 0.03 | 9 | 7 | 56.25 |
| **NC** | North Wrightsville Beach | 30 | 0.78 | 0.35 | 233 | 96 | 70.82 |
| **CT** | Housatonic: Milford Shoreline | 715 | 0.42 | 0.00 | 19 | 0 | 100.00 |

# FUTURE DIRECTIONS

Our results indicate that shorebirds are less likely to occupy habitats as human use increases and in the presence of dogs. Normal maintenance behaviors for these birds are disrupted in these situations, which could negatively impact these species and partially explain the variation in abundance observed. Closures were effective in lowering the number of disturbances and enhancing the population response of these species, suggesting that efforts to lessen disturbance frequency and intensity could be successful at increasing abundance at a site, thus improving the quality of the habitat and its capacity to service more birds.

The protocol we developed is currently being used by additional sites that were not originally participating in this study. Partners in Georgia and additional partners in South Carolina have implemented data collection at a number of sites to quantify disturbance and to guide future management activities. In addition to the focal species included in this study, they've added additional species to fit their project-specific needs including, Dunlin (*Calidris alpina*), Ruddy Turnstones (*Arenaria interpres*), Sanderling (*Calidris alba*), and Semipalmated Plovers (*Charadrius semipalmatus*).

If continuation of flyway-wide data collection is implemented, we also suggest including species that are perceived to be more disturbance tolerant, including Sanderling and Ruddy Turnstones. During this study, focal species weren't often present in more disturbed areas, which resulted in proportionally fewer behavioral samples in these areas. Therefore, we believe that adding species such as Sanderling and Ruddy Turnstones, that are perceived to be more disturbance tolerant, may result in more behavioral samples and further insight on how species react to potential disturbance.

In addition to the biological tracking afforded by these protocols, they also provide a standardized way of measuring potential disturbances at a flyway scale. These measures can be used as metrics to assess the success of any attempts to lessen disturbance both in terms of the occurrence of these activities and in terms of the response of shorebirds to any changes. The first year of data collection can serve as a baseline measure of the abundance and distribution of potential disturbances and management strategies in addition to information on species behavior and abundances. In addition, we are working to pair biological data collection and results with the findings from land manager surveys and surveys of dog walkers on selected beaches to inform the Community Based Social Marketing piece of this project.

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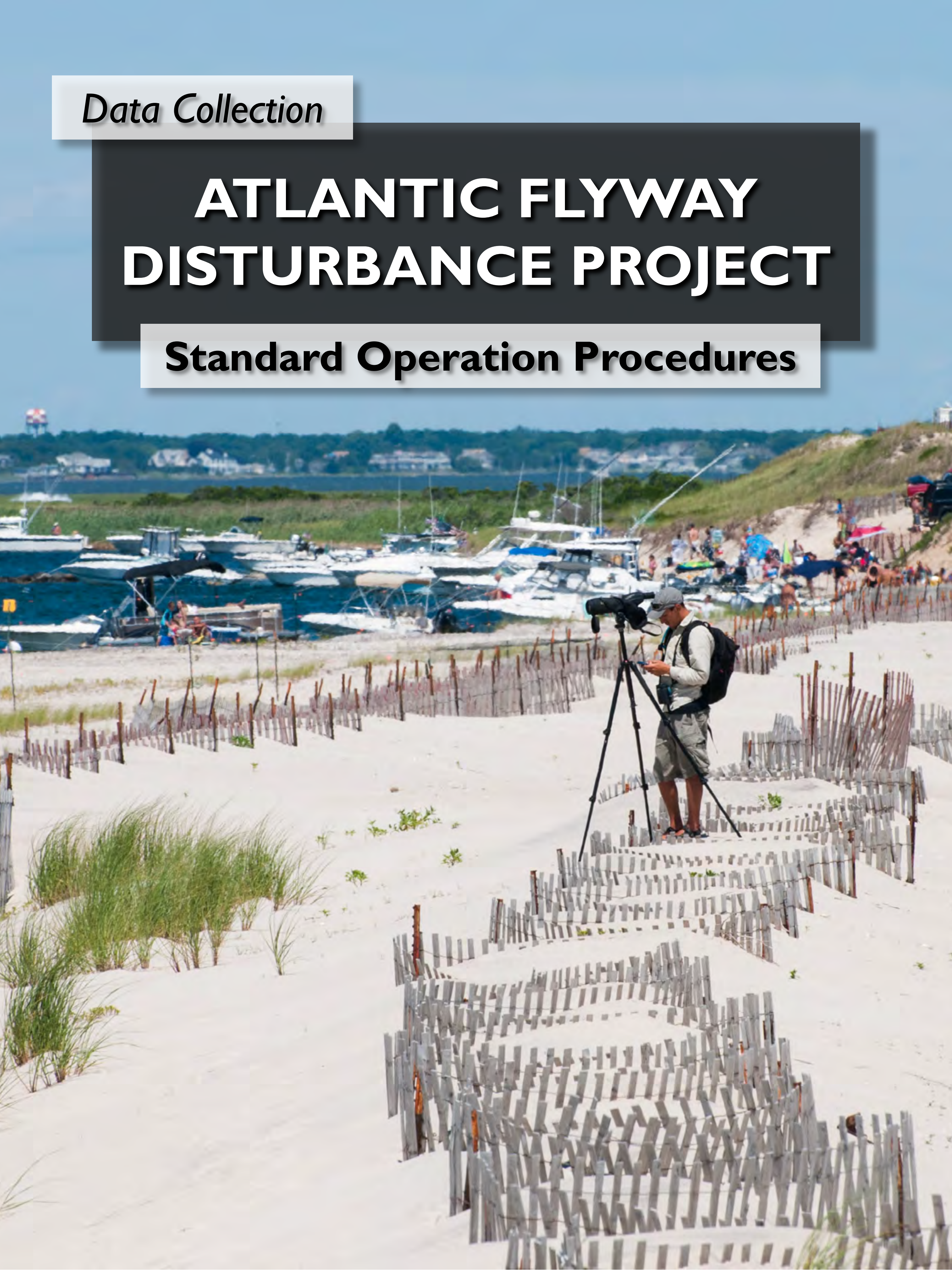
# APPENDIX A: Atlantic Flyway Disturbance Project Standard Operating Procedures and Datasheets

Data Collection

# ATLANTIC FLYWAY DISTURBANCE PROJECT

## Standard Operation Procedures



This project is a collaborative effort between the National Audubon Society, the Virginia Tech Shorebird Program and the Dayer Human Dimensions Lab, and the Department of Fish and Wildlife Conservation at Virginia Tech.

This work was funded by the National Fish and Wildlife Foundation.

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Audrey DeRose-Wilson

# TABLE OF CONTENTS

# Introduction

Hello!! Thank you for your participation in the Atlantic Flyway Disturbance Project funded by the National Fish and Wildlife Foundation. We are happy to have you on board and look forward to working with you throughout the duration of this project. The purpose of this project is to develop standardized, scientifically-sound guidelines and metrics for assessing the impacts of disturbance that can be applied across the Atlantic Flyway and guide the design of effective social marketing campaign(s) for changing human behavior causing detrimental disturbance. This project will assess the types of human disturbance, frequency, response of shorebirds, and effectiveness of various techniques used to control disturbance. With the information collected, we will determine the associations among coastal habitat conditions, human disturbance, and shorebird foraging behavior, habitat use, and demography. This information will help identify the human dimensions focus of this project (studying the drivers of critical human behaviors causing disturbance) and ultimately recommending how to design social marketing campaigns.

Below you will find standard operating procedures (SOP) for each of the data types (both in the field and out of the field) that our team is collecting. With this SOP you should have also received:

- ✧ An excel database for data entry that contains tables for each of the data types you will be collecting/sharing.
- ✧ An excel form with the two datasheets for use in the field.

When you first receive this information, we suggest reading through the SOP and having the database and datasheets open or available to ensure everything is clear and that we've provided enough information for you to collect data correctly and efficiently. If you have questions while perusing these resources, or at any point during data collection, **please contact Kelsi Hunt (hunt0382@vt.edu, 540.315.0551).** Below is a brief overview of the data we will be collecting and how it will be used:

- ✧ **Site information:** Site information will be used to classify the types and levels of human disturbances that are unique to a given site, as well as identify the similarities in experienced disturbance shared among monitored sites. This information will be used to identify the types of disturbances that may influence shorebird behavior and demography, which can then be used to inform management objectives.
- ✧ **Point counts:** Point counts will serve as the linkage between the frequency of human disturbance and shorebird demography and habitat use. By collecting human and shorebird use data simultaneously in specified locations, we can determine whether

human activities directly impact fine-scale shorebird habitat use, as well as local patterns in shorebird abundance.

- **Behavioral samples (not collected during the breeding season):** Behavior data collected alongside point count data will provide us with the opportunity to identify and understand the ecological mechanisms (e.g., altered feeding or resting regimes, habitat avoidance, etc.) linking human disturbance and shorebird population dynamics, which will better guide management decisions.
- **Productivity information:** Reproductive activity and success will provide an opportunity to determine indirect associations between human use of shorelines and local production. Depending on the variety of ongoing management actions and human disturbances, this will also allow us to determine the effectiveness of various management regulations on relative shorebird production.

# Field Procedures: Point Counts and Behavioral Samples

## Before going into the field…

**Step 1: Choose sites to be included**

You will need to choose sites to be included in this study. In general, we suggest that sites have different landowners. **We also suggest that you choose sites with both high and low levels of disturbance as well as varying numbers of the focal species of this project (American Oystercatcher, Piping Plover, Wilson's Plover, Red Knot, and Semipalmated Sandpiper).** The site size doesn't necessarily matter (but see more in Step 2 and the FAQ's). It is fine if the level of disturbance varies throughout the site, using the methods described in Step 2, we should be able to detect the variance in disturbance.

**Step 2: Designate points at each site where you will conduct point counts with a 200m radius and behavioral samples.**

Please take your site and divide it into 12 equal (or almost equal parts), which will give you 10 locations (skipping the beginning and ending point) where you will take point counts (with a 200 m radius) and behavioral samples and enter these locations into your GPS unit (latitude/longitude in decimal degrees). We will also ask you to provide some information about these points/locations in the 'Point Count Locations' form of your database (see Non-Field Data Entry below for specifics). **If your site is smaller than 4 km (the site size needed to accommodate 10 points with a 200 m radius around the point), please try to fit as many points as your site can accommodate, making sure that the radii of the**

**circles do not overlap.** Please see the FAQ's if you have questions about the size of your site or how to get the 10 locations.

### Step 3: Pre-data collection practice

As we are counting potential disturbances as well as numbers of focal species within a 200 m radius, it will be beneficial to take time to measure out 200 m so you get an idea of what the distance looks like, prior to going into the field.

## FAQ's

***1. What about sandbars that are underwater at high tide but that would be places where the focal species forage at mid or low tide? Should those be included? As a separate site or part of a larger inlet area? There would be different management regimes from one place to another.***

Good question. If they are a different management regime, we recommend leaving them out.

***2. Should we include high tide roost sites, even though we may not be able to visit/collect data as frequently due to the tide?***

Great question. We think that high tide roost sites and the behaviors associated are very important and therefore we suggest that you do include these sites (if you have them), with the understanding that you may not be able to visit as frequently.

***3. What if my site or sites are less than 4 km and the 200 m radius for the point counts will overlap? Or what if my site or sites are large and the 10 points may not capture the true human activity or the counts of the focal species?***

We developed the datasheets and standard operating procedures without knowing the specific sites that would be participating, but these methods are flexible. If your site or sites fall into either of the above categories, please contact Kelsi Hunt (hunt0382@vt.edu, 540.315.0551) to talk about ways to solve this. **The main point to make is that we don't want the 200 m radii to overlap, so less than 10 points at smaller sites will be necessary.**

***4. Related to the site size question, how many points should there be, minimum?***

There really isn't a minimum number of points at a site per se, although we would prefer that each site has at least three points. What we would be concerned about is the lack of point count and behavioral samples in terms of data analysis. So, if all of your sites are small in size with a low number of points each, we may have to think about increasing the number of samples you take during each site visit.

**5. *Do you have any suggestions for ways to get the points?***

Feel free to use any technique to get the points to be used for the point count/behavioral sample locations. If you are unsure, you can use the line transect tool in Google Maps or Earth and enter the points into your GPS prior to your first time in the field. Another option could be to get the total distance of your site, split it into equal parts, figure out the distance between your points and then take the locations in the GPS on your first field visit.

**6. *After we break up a site into 12 segments (if large enough), how should we determine where the survey points are? Randomly pick a point within each segment but >400m from the other points?***

Yes, as long as the point counts don't overlap, you can choose where you would like the point to be within each segment. It is also important that you are not choosing point based on where you think the birds will be or where the most disturbance will be. You can, however, shift the points in order to better see the entire 200 m, or to get a better view of the habitat.

***7. What about visual impediments at points? For example, can the circle include water? Or what about a situation where a dune in the middle of a peninsula would block the ability to see both shores?***

In a perfect world for point count data collection, you would be able to see the entire 200 m radius. However, we understand that this isn't going to be possible everywhere. So yes, it's ok to have some of circle over water and it's ok if some of your view included in the 200 m radius is obstructed. If this is the case, we ask that you add a brief description of this to the comments of the 'Point Description' spreadsheet (explained in detail below).

**8. *What if our point ends up being too close to a nest? Is it OK to move it?***

Yes, moving the point count to an area close by where you're not disturbing the nest would be best.

## Collecting data in the field…

We hope to collect field data **10–12 time per site per season** (fall migration (August 1- October 31), winter (November 1- January 31), spring migration (February 1 – March 31), and the breeding season (April 1 – July 31)) that you are participating in the Disturbance Project. As potential disturbances may change depending on the time of day, we ask that you collect field data 5–6 times per site per season in the morning (sunrise to noon) and 5–6 times per site per season during the afternoon (noon to sunset). To capture human use and shorebird counts throughout the season, it would be beneficial if the data collection was spread out throughout the season, if possible. As weekends and holidays may have some of the highest levels of disturbance, it will also be beneficial to attempt to get point count and behavioral samples at those times, if possible.

We recommend that you have at **least two people** in the field each time you are collecting data. This will optimize your ability to do point counts and especially behavioral samples, as you can have one person recording the data and the other conducting the point count and behavioral sample. If you are unable to go out with a partner, we recommend using a voice recorder or a voice recording smartphone app and transcribing the data onto a datasheet later.

**When collecting data, please follow these steps:**

**Step 1: Make sure you have all of the equipment you will need, including:**

- ✧ **Datasheets:** please bring your point count and behavioral sample datasheets into the field with you each time you collect data. Please bring one datasheet of both types per site that you plan to visit that day.
- ✧ **Optics:** please bring a spotting scope and binoculars.
- ✧ **GPS unit:** please bring your GPS unit with your programmed points where you will conduct point counts and behavioral samples.
- ✧ **Watch/stopwatch/smart phone:** please bring something to keep time, as well as a stopwatch or smart phone with an app that will beep every 10 sec during behavioral samples.
- ✧ **Clicker counter:** please bring a clicker counter if you think it will be beneficial for counting potential disturbance types and shorebirds (i.e., if you have a very busy site for people and/or birds).
- ✧ **Kestrel/smart phone:** please bring something that will allow you to get the temperature (C°), wind speed (km/hr), and wind direction when you enter and exit the site. A Kestrel would be ideal as it allows you to take temperature and wind speed in real time, but a smartphone app that gives info for the nearest weather station will work as well.

**Step 2:**

When you enter your site, please fill out the top of the ‘point count’ datasheet with the site, date, weather and tide information.

**Step 3:**

Navigate to your first location. When you reach the location, wait **3 minutes** prior to conducting your point count. This will allow you to get your gear ready and will also allow for the birds to settle. If you come to a point without any focal shorebird species or potential disturbance sources, you will still wait the 3 minutes. After the 3 minutes you will conduct a point count where you count all potential disturbances listed on the datasheet as well as the number of focal species (American Oystercatcher, Piping Plover, Wilson's Plover, Red Knot, Semipalmated Sandpiper (or peeps)) within a 200 m radius (with the observer(s) at the center and counting focal species and potential disturbances within 200 m in all directions).

***A few things to note:***

- ✧ We don't have a set amount of time for the point counts. We hope for them to be a fairly quick 'snapshot' of what's going on at the point. However, if you have a lot of species and/or disturbance types, it may be challenging to be 'quick'. We don't have a specific amount of time set as it will vary by how many birds and potential disturbances as well as how familiar you are with the technique.

- ✧ If you have large flocks of birds, it is suggested that instead of counting individuals, you estimate the flock size. For example, you could focus your scope on a flock and count the number of individuals within the scope and then extrapolate that for the rest of the flock. If you counted 50 individuals and it would take 10 scope views to cover the entire flock, then you would have a flock of 500 birds.

- ✧ Inevitably birds will move in and out of the 200 m. If they fly or walk into the 200 m in front of where you've counted, they **would** be included in the total count. If you observe them flying or walking into the area that you've already counted, they **would not** be included in the total count.

- ✧ Depending on the number of focal shorebird species and what is most efficient for you and your partner, feel free to count all species at once as you scan through the point count, OR you can count each species separately. The same is true for potential disturbance sources.

- ✧ If you think at **any time** throughout data collection that you will had trouble distinguishing Semipalmated sandpipers from Western Sandpipers, please lump them together and count/record the number of 'peeps' within a 200 m radius. If you feel that you will always be able to distinguish between the two, please count/record only the number of Semipalmated Sandpipers.

**Step 4:**

Immediately following the point count, you will conduct behavioral samples at the same location. **We will conduct behavioral samples during the winter and both migrations, but <u>not during the breeding season</u>.** To start, scan the area within the 200 m for one of the focal species. If you locate an individual, you will conduct a sample on that individual. If you locate a flock, choose an individual in the middle of the "flock" and conduct the sample. If you lose sight of the individual, chose another individual from the middle of the "flock" and continue the observation. When you've completed the sample, scan the area again for a different focal species, choose the individual that will be sampled, and complete the sample. Continue this until you've scanned for each of the five focal species. Depending on your general location in the flyway, or season, you will end up with **0–5 behavioral samples per location, totaling 0–50 samples per site visit.** We know that 50 samples seems like A LOT… however, we expect that it will be extremely rare (nearly impossible) to locate all five species at each sampling location. If you think this will be a regular occurrence at your site, let's discuss ways to reduce the number of samples. Having a sufficient sample size to understand behavior across a range of species will be difficult, and we are trying to maximize this sample where possible to ensure that our hard work is not in vain.

For example, if you scan the area and only find American Oystercatchers, you will end up with one behavioral sample for that location. If you scan and locate and American Oystercatchers and Red Knots, you will end up with two samples for that location. If you scan and locate all five focal species, you will end up with five samples for that location. If you scan and locate none of the focal species, then there will be no behavioral sample for that location.

**Step 5:**

Repeat Steps 2–3 until you've visited all points at your site. Please be mindful of your own disturbance while conducting point counts and behavioral samples. For example, try to keep a 50 m buffer between yourselves and the focal bird species (see minimum approach distances in Livezey, Fernandez-Juricic, & Blumstein, 2016). However, if the 50 m buffer is not possible given the width of your beach, as long as the birds continue or return to 'normal behavior', a buffer of < 50 m should be fine.

**Step 6:**

Fill out the rest of the information at the top of the datasheet regarding the weather as you exit the site.

**Step 7:**

Enter your data into the Excel database. We suggest that you enter data into the database as often as possible. After each occasion in the field would be preferable, however we understand that may not be possible and suggest that you attempt to enter data at least once/week. At the start of each season, we may ask that you enter data more frequently so we can troubleshoot any issues and make sure that data collection is going well.

## FAQ's

### *9. Why do we need to collect so much data?*

We appreciate that the amount of data that we're collecting may seem overwhelming. However, our ability to detect an effect of disturbance on the focal shorebird species is dependent on the number of samples we are able to collect. For most seasons, 10-12 field occasions will require you to collect data at each site about one time/week. If this doesn't seem possible, we are open to discussing ways to make the data collection procedures work for you. If you have multiple sites, we are definitely open to reducing the number of samples taken per site. **We really appreciate all of the effort you are putting into this project; thank you!!**

### *10. Can we adjust the survey period time frames for spring migration, breeding, fall migration, and winter? And if the season is shorter, do we still need to collect 10–12 points?*

Yes, you can definitely adjust the timing of your season depending on your location and when migration/breeding/wintering happen at your site. And for any of the shorter periods, it works to decrease the number of visits you make. As a rough guideline, it would be great if you could try to visit each site once a week, but we understand and are flexible if that's not a possibility. We've added 'season start date' and 'season end date' columns into the 'site information' spreadsheet so you can let us know how you broke up the seasons.

### *11. Do you have any smart phone app suggestions for behavioral samples?*

We've used 'Interval Timer' on other projects and found it to be user friendly. It allows you to set the total time as well as how often you would like it to beep. It even lets you choose what sound you'd like to hear when it beeps!

### *12. Do you have any smart phone app suggestions for collecting weather data?*

You may know better than we do what weather apps are the most accurate in your area. A few that we've used in the past are 'The Weather Channel', 'Weather Underground', 'Weather Bug,' and 'Marine Weather Forecast'.

### *13. Do the point counts have to be done one after another (i.e., no other work like counts for ISS can be done between each point count/behavioral observations)?*

It would be great if all of the point counts and behavioral samples at a site were done one right after the other, however we understand that you are busy and may have other field tasks to accomplish during your visit. Therefore, as long as each pair of point counts and the accompanying behavioral samples occur one right after the other, it's fine if you complete other field tasks between the points.

***14. Can you better explain how you choose individuals for the behavioral samples?***

If you have multiple individuals of the same focal species ("flock"), you will choose an individual in the middle of the flock. If you lose track of that individual, please locate another individual and continue to behavioral observation. We understand that not all of the focal species spend time in "flocks" but the premise will be the same. For example, if you have 4 Piping Plovers within the 200 m, and one flies away, choose another and continue to sample. However, if you have just one individual and it leaves or your view of it becomes obstructed, you will continue the sample, choosing 'OS' (out of sight, see below) as the behavior code.

***15. Do you have any idea how long each visit may take? Or how long it will take to conduct a point count/behavioral sample at each point?***

There will be a lot of variation due to site size, both in the number of points and how long it takes to walk between points. It will also depend on the number of target species and number of potential disturbances for the point count and also the number of target species for the behavioral sample. It will also depend on the experience of the observer, as for something like point counts, you may get faster/more efficient with experience. Below is an example of how long it could take to do one point count/behavioral sample with a high number of birds and potential disturbances (so potentially the maximum amount of time at the point).

1. Arrive at point
2. Wait for birds to resume 'normal behavior' and get gear ready: **3 minutes**
3. Conduct a point count with a high number of birds and disturbance types: **5 minutes** (this is just an estimate as there is no set time for point counts)
4. Behavioral samples with all target species present: **15 min (3 min for each of the 5 species)**
5. Leave point

That would be 23 minutes, which is a lot. However, we don't expect that you will have many situations where all 5 species are present in your point count/for your behavioral sample. As we mentioned before, if it becomes too time consuming, we are happy to chat about ways to make it more efficient and work for you.

For the entire survey, when Lara Mengak followed a similar protocol for our Refuges project, it took, generally, 1 hour to conduct each pass of a site (approximately 1.5 miles long with 6 points). Depending on the number of focal species at a site, behavioral observations may have taken up to 1.5 hours per site. She did behavioral observations in one direction and point counts (as well as transect counts with a more extensive human activity component) in the opposite direction.

***16. Do you have any suggestions for training to make sure the data is being collected consistently at sites?***

If you have the time, we suggest a trial run where observers collect the point count and behavioral samples together to ensure correct identification of birds and classification of disturbance sources. Please take time to discuss the data you collected and the differences in the data collected to identify potential issues. Data collected during this trial will not be entered in database. We are happy to discuss and consult as need be.

# Field Datasheets and Data Entry: Point Counts and Behavioral Samples

## Point Counts: Complete this form every time you conduct a point count

Please print off the 'Point Count' datasheet to fill out in the field and enter the data in the corresponding excel forms in your database when you return from the field.

- **STATE:** Record the state abbreviation.
- **SITE:** Record the name of the site.
- **DATE:** Record the date **(mm/dd/yyyy)**.
- **1$^{ST}$ HIGH TIDE:** Record the time **(military time)** of the first high tide of the day. You can obtain this from your favorite tide chart or website.
- **TIME IN:** Record the time **(military time)** you enter the site.
- **TIME OUT:** Record the time **(military time)** you leave the site.
- **TEMP IN:** Record the temperature **(C°)** when you enter the site.
- **TEMP OUT:** Record the temperature **(C°)** when you leave the site.
- **WIND SPEED IN:** Record the wind speed **(km/hr)** when you enter the site.
- **WIND SPEED OUT:** Record the wind speed **(km/hr)** when you leave the site.
- **OBSERVER(S):** Record the name(s) of observers conducting the point count and subsequent behavioral observation.
- **POINT #:** Please record the point/location number (1-10). These numbers should correspond with the locations you chose and entered into your GPS unit prior to

fieldwork. These should also match the 'Point #' for the behavioral sample(s) done at the same location.

- **START TIME:** Record the time **(military time)** when you start each point count.
- **POINT IN CLOSED AREA OR SYMBOLIC FENCING? (Y/N):** Place a 'Y' here if **you or any part of your 200 m radius** fall within a closed area or within symbolic fencing.
- **# VEHICLES:** Record the number of vehicles (e.g., cars, trucks, ORVs) parked or moving within 200 m.
- **# BOATS:** Record the number of boats **PARKED ONSHORE** within 200 m.
- **# AERIAL:** Record the number of human-related aerial disturbances (airplanes, helicopters, drones, kites, kite surfers, parasails etc.) within 200 m and up to 500 m vertically.
- **# DOGS, UNLEASHED:** Record the number of unleashed dogs within 200 m.
- **# DOGS, LEASHED:** Record the number of leashed dogs with 200 m.
- **# PEOPLE, MOVING:** Record the number of moving people within 200 m, **count people BOTH in and out of the water**. You will not count yourselves in this.
- **# PEOPLE, AT REST:** Record the number of people at rest within 200 m, **count people BOTH in and out of the water**.
- **# PREDATORS:** Record the number of potential predators of adult shorebirds (e.g., peregrine falcon, merlin, cats, fox, gulls etc.) within 200 m.
- **# PIPL:** Record the number of Piping Plovers within 200 m.
- **# AMOY:** Record the number of American Oystercatchers within 200 m.
- **# REKN:** Record the number of Red Knots within 200 m.
- **# WIPL:** Record the number of Wilson's Plovers within 200 m.
- **# SESA:** Record the number of Semipalmated Sandpipers within 200 m.
- **# PEEPS:** If you are not confident that you will **ALWAYS** be able to distinguish SESA from WESA, please use this column to record the number of SESA/WESA or 'peeps' within 200 m.
- **COMMENTS:** Note any important information from the point count.

## Behavioral Samples: Complete this form every time you conduct a behavioral sample: **PLEASE NOTE, BEHAVIOR SAMPLES WILL <u>NOT</u> BE CONDUCTED DURING THE BREEDING SEASON**

Please print off the 'Behavioral Sample' datasheet to fill out in the field and enter the data in the corresponding excel forms in your database when you return from the field.

- **STATE:** Record the state abbreviation.
- **SITE:** Record the name of the site.
- **DATE:** Record the date. **(mm/dd/yyyy)**
- **POINT #:** Please record the point/location number (1-10). These numbers should correspond with the locations you chose and entered into your GPS unit prior to fieldwork. These should also match the 'Point #' for the point count done at the same location.
- **SPECIES:** Record the species abbreviation (AMOY, PIPL, REKN, WIPL, SESA (or peeps)) that you are conducting the behavioral sample on.
- **0:10-3:00:** Record the behavior of the bird every 10 seconds using the codes below. Please record direct disturbance events (e.g., being chased by a dog, being displaced due to a human running along the beach, being pursued by a predator, etc.) in the comments noting disturbance type, distance from bird, and time
  - **F:** foraging (these are referring to instantaneous behavior so you would only use this if the individual is pecking, probing, carrying prey, etc. when the timer beeps.
  - **M:** mobile
  - **R:** resting (roosting, loafing, etc.)
  - **A:** alert/vigilant (this would include territorial disputes)
  - **FL:** flying
  - **OS:** out of sight If there is a "flock" of individuals and you are choosing a new individual of the same species if you lose track of the original, you shouldn't record multiple 'OS' in a row. However, if there was only one individual of a specific species, you would continue to record 'OS' until you've completed the 3-minute sample or another individual arrives at your location.

- **O:** other (please describe in comments)

**COMMENTS:** Note any other important information from the sample.

# Non-Field Data Entry: Point Count Locations, Site Information & Productivity Information

## Point Count Locations: Please complete this after you've selected the locations where you will conduct point counts and behavioral samples

Please fill this out after you have selected the locations where you will conduct point counts and behavioral samples. As each site will have up to 10 locations where point counts and behavioral samples are conducted, the numbers in the 'Point #' column correspond to each point. If you have more sites, please copy and paste 1-10 for as many sites as you have. **Thank you!**

- **STATE:** Record the state abbreviation.
- **SITE:** Record the name of the site.
- **POINT #:** The point number at the specified site.
- **LATITUDE:** Record the point latitude in **decimal degrees**.
- **LONGITUDE:** Record the point longitude in **decimal degrees**.
- **COMMENTS:** Note any important information regarding the point. For example, if your view is impeded for a portion of the point or part of the point is over water, please provide a brief description here.

## Site Specific Information: Please complete this for each site during each season

Please complete the 'Site Information' form in your excel database for each of the site(s) where you are collecting data related to the NFWF Disturbance Project. This data will be used to gather information about larger-site level potential disturbances as well as information regarding site-level disturbance management. **As potential disturbances and management can change depending on the season, we ask that you fill out one row of data per site per season (totaling 1–4 rows per site)**. For example, if you are a site that is participating and collecting data during fall migration, winter, spring migration, and the breeding season, you would fill out four rows for each site. If you are a site that is participating and collecting data in the winter, you would fill out one row for your site. Below you will find details and descriptions for each of the columns in the form **Thank you!**

- **STATE:** Record the state abbreviation.
- **SITE:** Record the name of the site.
- **SITE LEGNTH:** Record the length of your site (m).
- **SEASON:** Record the season(s) that you are completing the NFWF Disturbance Project point counts and behavioral samples.
  - **Fall**
  - **Winter**
  - **Spring**
  - **Breeding**
- **SEASON START DATE:** Record the start date of your season. As seasons may vary depending on location, we wanted to give you the flexibility to dictate when each season starts and ends. **(mm/dd/yyyy)**
- **SEASON END DATE:** Record the end date of your season. As seasons may vary depending on location, we wanted to give you the flexibility to dictate when each season starts and ends. **(mm/dd/yyyy)**
- **SITE STARTING POINT:** Record the latitude and longitude at the starting point of your site in decimal degrees.
- **SITE ENDING POINT:** Record the latitude and longitude at the ending point of your site in decimal degrees.
- **MANAGING AGENCY OR GROUP:** Record the agency, group, etc. responsible for managing natural resources (shorebirds) at the site.
- **LANDOWNER:** Record the name(s) of the site landowner(s), please record uknown if you do not have information regarding the landowner.

- **# PEDESTRIAN ACCESS POINTS:** Record the number of pedestrian access points at your site. This should include both formalized access points such as boardwalks as well as information trails used to access the site.
- **# VEHICLE ACCESS POINTS:** Record the number of vehicle access points at your site. This should include formalized access points as well as information (or illegal) trails used to access the site.
- **NEAREST PARKING LOT:** Record the distance (in km) from the site entry point to the nearest parking lot. If there are multiple lots or entry points, record the closest distance (km) between a parking lot and entry point.
- **# OF PARKING SPOTS:** Record your best guess at the number of parking spots available used to access the site.
- **BOAT ACCESS ONLY (Y/N):** Place a 'Y' here if the site is only accessible by boat, place an 'N' here if it is not.
- **DISTANCE TO NEAREST PUBLIC RAMP (km; if boat access only):** If you placed a 'Y' in the previous column, please record the distance (in km) to the nearest boat ramp.
- **POTENTIAL DISTURBANCE INFORMATION:** Please record any of the following site-level potential disturbance information that occurred at your site during the season specified.
    - **DOGS ALLOWED?**: Please use the codes below this column:
        - **A:** Dogs (leashed or unleashed) are allowed at the site.
        - **L:** Leashed dogs only are allowed at the site.
        - **N:** Dogs are not allowed at the site.
    - **BEACH RAKING? (Y/N):** Place a 'Y' here if beach raking occurred, place a 'N' if beach raking did not occur.
    - **BEACH RAKING FREQUENCY:** Record how often beach raking occurred.
    - **BEACH MODIFICATION? (Y/N):** Place a 'Y' here if beach modifications (e.g., renourishment, stabilization, inlet relocation or filling) have occurred in the last 10 years, place an 'N' if beach modifications have not occurred.
    - **YEAR OF LAST BEACH MODIFICATION:** Record when the last beach modification occurred.

- **MAJOR EVENTS? (Y/N):** Place a 'Y' here if any major events (e.g., concerts, weddings, large parties, etc.) have occurred, place an 'N' if major events have not occurred.
- **# OF MAJOR EVENTS THIS SEASON?:** Record the number of major events that have occurred in the specified season.

- **DISTURBANCE MANAGEMENT:** Please record any of the following site-level disturbance management information that occurred at your site during the specified season.
  - **SYMBOLIC FENCING MANAGEMENT START DATE?:** If you used symbolic fencing, please record the date that you started putting up symbolic fencing. **(mm/dd/yyyy)**
  - **SYMBOLIC FENCING MANAGEMENT END DATE?:** If you used symbolic fencing, please record the date that you finished taking down symbolic fencing. **(mm/dd/yyyy)**
  - **NEST EXCLOSURES? (Y/N):** Place a 'Y' here if nest exclosures were used at any point throughout the season, place an 'N' here if nest exclosures were not used.
  - **DRIVING CLOSED AREA START DATE?:** If part or all of your site was closed to driving during this season, please record the date that the FIRST area was closed. For our purposes, we define closed area as areas are completely closed and they may not be the entire site. This can be IN ADDITION to symbolic fencing. **(mm/dd/yyyy)**
  - **DRIVING CLOSED AREA END DATE?**: If part or all of your site was closed to driving during this season, please record the date that the LAST closed area was removed. For our purposes, we define closed area as areas are completely closed and they may not be the entire site. This can be IN ADDITION to symbolic fencing. **(mm/dd/yyyy)**
  - **PEDESTRIAN CLOSED AREA START DATE?**: If part or all of your site was closed to pedestrians during this season, please record the date that the FIRST area was closed. For our purposes, we define closed area as areas are

completely closed and they may not encompass the site. This can be IN ADDITION to symbolic fencing. **(mm/dd/yyyy)**

- **PEDESTRIAN CLOSED AREA END DATE?**: If part or all of your site was closed to pedestrians during this season, please record the date that the LAST closed area was removed. For our purposes, we define closed area as areas are completely closed and they may not encompass the entire site. This can be IN ADDITION to symbolic fencing. **(mm/dd/yyyy)**
- **REGULATORY SIGNS? (Y/N):** Place a 'Y' here if regulatory signs or signs indicating permitted and unpermitted behavior (e.g., signs designating where people can/cannot go, signs regarding whether or not dogs are allowed on the beach, signs indicating that dogs must be on leash, etc.) were used at **the site entrance, access points or parking lots, etc.**, place an 'N' here if regulatory signs were not used.
- **INTERPRETIVE SIGNS? (Y/N):** Place a 'Y' here if interpretive signs related to shorebird disturbance (e.g., signs describing the effects of human disturbance, etc.) were used at **the site entrance, access points or parking lots, etc.**, place an 'N' here if interpretive signs were not used.
- **MONITORS OR EDUCATORS?:** Use the codes below to fill out this column:
  - **M:** Place an 'M' here if biological monitors were present at your site.
  - **E:** Place an 'E' here if educational staff (managing disturbance or educating the public about disturbance) were present at your site.
  - **B:** Place a 'B' here if both biological monitors and educational staff were present at your site.
  - **N:** Place an 'N' here if there were not biological monitors or educators present at your site.
- **LAW ENFORCEMENT?:** Use the codes below to fill out this column:
  - **1:** Full-time law enforcement
  - **2:** Periodic patrol
  - **3:** On-call
  - **4:** None

- ❖ **RECORD COMPLIANCE? (Y/N):** Place a 'Y' here is you record compliance (e.g., footprints inside closures, off-leash dogs where not permitted, etc.) and report on that data (internally, externally), place a 'N' here if you do not.
- ❖ **OTHER?:** Place a 'Y' here if you used another form of disturbance management not listed above at your site and add a description to the comments section, place a 'N' here if you did not use another form of disturbance management.

- **COMMENTS:** Note any other important information regarding the site and its human use.

## Productivity Information: Please complete this form for each focal species nest/brood.

If you are a site or sites participating in the NFWF Disturbance Project during the breeding season of one or more of the focal species (American Oystercatcher, Piping Plover, or Wilson's Plover), please complete the 'Productivity' excel form in your database. **This information is not directly related to the point count samples and therefore please include information for ALL focal species nests at your sites (if you collect it), even if they occur outside of your point count circles.**

This data will be used in an attempt to link disturbance to productivity. **Each nest/brood will require that you give it a unique ID and that fill out as much information as possible (totaling 1 row of data per nest/brood).** We understand that you may not collect all of the data asked in this form, especially in regard to brood information, but please fill out what you can. Below you will find details and descriptions for each of the columns in the form. **Thank you!**

- **ID:** Please give each nest/brood a unique ID.
- **STATE:** Record your state abbreviation.
- **SITE:** Record the site where the nest was located.
- **NEST LATITUDE:** Record the nest latitude in decimal degrees.
- **NEST LONGITUDE:** Record the nest longitude in decimal degrees.
- **SPECIES:** Record the species abbreviation (AMOY, PIPL, REKN, WIPL, SESA) of the nest/brood.

- **FOUND ON DATE:** Record the date you found the nest. **(mm/dd/yyyy)**
- **INITIATION DATE:** Record the date that the nest was initiated (if known), place a 'U' here if you are unsure of the initiation date. **(mm/dd/yyyy)**
- **EGG #:** Record the highest (total) number of eggs observed.
- **EXCLOSED? (Y/N):** Place an 'Y' here if the nest was exclosed at any point during incubation, place a 'N' if it was not.
- **DATE EXCLOSED (IF KNOWN):** Please record the date the nest was exclosed, if known. **(mm/dd/yyyy)**
- **SYMBOLIC FENCING? (Y/N):** Place an 'Y' here if the nest was surrounded by symbolic fencing at any point during incubation, place a 'N' if it was not.
- **AREA CLOSED?:** If the nest was within a closed area, please use the following codes for the area closed column, if the nest was within a closed area:
    - **N:** The area was not closed.
    - **D:** The area was closed to driving, however people, pets, etc. could still use the area.
    - **P:** The area was closed to the public.
- **NEST FAILED (Y/N)?:** Place a 'Y' here is the nest failed, place a 'N' here if it was successful.
- **FAIL DATE:** Record the date of nest failure. If you are unsure, record the date that you observed the nest failed. **(mm/dd/yyyy)**
- **HOW DID THE NEST FAIL?**: Please use the following codes for the different types of nest failure.
    - **A:** Place an 'A' here if the nest failed due to **abandonment**.
    - **P:** Place a 'P' here if the nest failed due to **predation**.
    - **W:** Place a 'W' here if the nest failed due to **weather**.
    - **T:** Place a 'T' here if the nest failed due to the **tide**.
    - **H:** Place an 'H' here if the nest failed due to **human interference**. Please record the specific type of human interference (if known) in the comments.
    - **O:** Place an 'O' here if the nest failed due to **another reason** not listed above and please provide details in the comments.

- **U:** Place a 'U' here if the nest failed but the reason for failure is **unknown**. This would include nests that failed without evidence before the expected hatch.

- **NEST SUCCESSFUL (≥ 1 egg hatched; Y/N):** Place a 'Y' here if the nest hatched ≥1 egg, place an 'N' here if the nest failed.
- **# EGGS HATCHED:** Record the number of eggs hatched (if known), place a 'U' here if you are unsure how many eggs hatched.
- **HATCH DATE:** Record the hatch date (if known). If you are unsure, record the date that you observed the nest hatched. **(mm/dd/yyyy)**
- **BROOD FATE (S/F/U)?:** Place an 'S' here if the brood survived to fledging, place an 'F' here if the brood did not survive to fledging. If the fate of the brood is unknown, place a 'U' here.
- **# CHICKS FLEDGED:** Record the number of chicks fledged (if known), place a 'U' here if you are unsure of the exact number.
- **FLEDGE DETERMINATION:** Record the method you used to determine that the chicks had fledged. For example, some locations considered chicks to be fledged at 25 days, and some wait until confirmed flight.
- **FLEDGE DATE:** Record the date of fledging (if known), if you are unsure record the date that you first observed the chicks fledged. **(mm/dd/yyyy)**
- **COMMENTS:** Note any important information regarding the nest/brood.

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

National Audubon Society
www.audubon.org

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

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

National Fish and Wildlife Foundation
www.nfwf.org

# POINT COUNT DATASHEET

**State:** state abbreviation. **Site:** site name. Date: today's date. 1st High Tide: the first high tide of the day. **Time In:** time **(military time)** you enter the site. **Time out:** time **(military time)** you leave the site. **Temp In:** temperature **(C°)** when you enter the site. **Temp out:** temperature **(C°)** when you leave the site. **Wind Speed In:** wind speed **(km/hr)** when you enter the site. **Wind Speed Out:** windspeed **(km/hr)** when you leave the site. **Observers:** the names of the observers. **Point #:** this should correspond to the pre-determined location in your GPS as well as the behavioral sample(s) you will subsequently conduct. **Start Time:** time **(military time)** when you start the point count. **Point in closed area or within symbolic fending? (Y/N):** whether or not you or any of your 200 m point count is in a closed area or an area within the symbolic fencing. **#Vehicles - # Predators:** the number of potential disturbance types within 200m. **# PIPL - # SESA:** the number of each of the focal species within 200m. **Comments:** note any important information from the point count.

| State: | Date: | Time In: | Temp In: | Wind Speed In: | Observers: |
|---|---|---|---|---|---|
| Site: | 1st High Tide: | Time Out: | Temp Out: | Wind Speed Out: | |

| | | | **Number of potential disturbance types** | | | | | | | | **Number of each species** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point # | Start Time | Point in closed area or within symbolic fending? (Y/N) | # Vehicles | # Boats | # Aerial | # Dogs, unleashed | # Dogs, leashed | # People, moving | # People, at rest | # Predators | # PIPL | # AMOY | # REKN | # WIPL | #SESA | #Peeps | Comments |
| 1 | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | |
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## BEHAVIORAL SAMPLING DATASHEET

**State:** state abbreviation. **Site:** site name. **Date:** today's date. **Point #:** this should correspond to the pre-determined location in your GPS as well as the point count you just conducted. Species: focal species abbreviation (AMOY, PIPL, REKN, WIPL, SESA), **0:10-3:00:** record the behavior of the bird every 10 sec using the following codes: **F=foraging, M=mobile, R=resting (roosting, loafing, etc.), A=alert/vigilant (including terretorial disputes), FL=flying, OS=out of site, O=other (explain in comments)** *Record direct disturbance events in the comments noting disturbance type, distance from bird, and time. **Comments:** note any important information from the behavioral sample.

| State: | Site: | Date: |
|---|---|---|

| Point # | Species | 0:10 | 0:20 | 0:30 | 0:40 | 0:50 | 1:00 | 1:10 | 1:20 | 1:30 | 1:40 | 1:50 | 2:00 | 2:10 | 2:20 | 2:30 | 2:40 | 2:50 | 3:00 | Comments* |
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