

SPACE TO ROOST: WORKING WITH RECREATIONAL BEACH USERS  
TO SET ASIDE HIGH-TIDE ROOSTING SPACE FOR MIGRATORY SHOREBIRDS  
IN THE MINAS BASIN OF THE BAY OF FUNDY, NOVA SCOTIA, CANADA

by

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## **DEDICATION**

*For Nanny and Poppa, who I miss every day. You always said I would publish something.*

*I hope this makes you proud.*

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## ABSTRACT

Migratory shorebird numbers are dropping, making shorebird conservation a necessity. Although conservation must incorporate human values, it is uncommon to develop strategies in collaboration with those seen as causing challenges. Through site audits, we identified anglers, photographers and others as causing shorebird disturbance at a roosting site in Nova Scotia. Through in-person surveys, an online survey, education, and outreach, we worked with recreational users to set aside a ‘Shorebird Resting Beach’ (SRB). Employing signage, handouts, and researcher presence, we asked users to avoid this beach from two hours before and after high tide in August. Baseline surveys of users and disturbance in 2016 were repeated in 2017 and 2018 when the SRB was launched. On the SRB, we found an overall decrease of 82% in the hourly rate of human-caused disturbance in 2017 from 2016, a 73% decrease from 2018 to 2016, and a 48% increase from 2017 to 2018. The number of users that went down to the SRB from the dyke dropped from just over half in 2016, to less than 10% in 2017 and 2% in 2018. The SRB had nearly half the hourly rate of disturbance of Middle Beach in 2016 and 2017, and a third in 2018. The SRB had less than a third of the rates of disturbance of East Beach in 2017 and 9.5 times less in 2018. Future work should include shorebird-human avoidance as a disturbance category and account for the proportion of birds disturbed of total shorebirds present. The implementation of SRBs shows promise as an effective tool when managers are confronted with conflicts between shorebirds and beach users.

## **LIST OF ABBREVIATIONS USED**

IBA: International Bird Area

NABCI: North American Bird Conservation Initiative

NS: Nova Scotia

NSDLF: Nova Scotia Department of Lands and Forestry

REB: Research Ethics Board (Dalhousie University)

Resting Beach: Shorebird Resting Beach

SRB: Shorebird Resting Beach

UNESCO: United Nations Educational, Scientific and Cultural Organization

WHSRN: Western Hemisphere Shorebird Reserve Network

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## CHAPTER 1: INTRODUCTION

### 1.1 Migratory shorebirds require ‘Space to Roost’

Migratory shorebirds, in particular Semipalmated Sandpipers (*Calidris pusilla*), have a range that extends from their breeding grounds in the Arctic to their wintering grounds in South America (Gratto-Trevor et al., 2012). There are many threats facing these birds as they migrate from the Arctic to South America, including changes in their breeding habitat due to climate change, predation, being hunted in South America, and disturbance during roosting and feeding time at their stopover sites. Taken together, these threats have resulted in reductions of 40% of all of Canada’s shorebird species since the 1970’s (NABCI, 2019). Migratory shorebirds use the Minas Basin of the Bay of Fundy in Nova Scotia, Canada as a critical stop-over site during their fall migration (Brown et al., 2017; Neima, 2016; Hicklin & Smith, 1984). This stopover takes place from mid-July to mid-September (Hicklin & Smith, 1984; Hicklin, 1987; Hamilton, Diamond & Wells, 2006; Gratto-Trevor et al., 2012), which coincides with peak recreational use of the same beaches on which the birds feed and roost. During high tide roosting periods, when their feeding grounds are covered by water, the birds are often disturbed by recreational beach users. Disturbances cause the birds to walk or fly away from the source of disturbance (Mann, 2015), wasting critical energy reserves required to make the 4,000 km over-ocean flight to South America (Gratto-Trevor et al., 2012; Helmers, 1992).

Space to Roost is a program led by Bird Studies Canada (now Birds Canada) to reduce disturbance by beach users to migratory shorebirds at high tide roosting sites. Space to Roost was designed based on engagement with a local naturalists’ group and recreational beach users, and a survey of striped bass anglers who are the main on-site user group at a site called The Guzzle in the Southern Bight of the Minas Basin, Nova Scotia. The project was created in order to

understand the role that collaborative conservation design plays in the protection of migratory shorebird roosting habitat; specifically, how conservation managers can collaborate with those beach users seen as causing harm, to help design and implement interventions to help reduce disturbance to these fall migrants.

This thesis will examine the results of a three-year study on migratory shorebird disturbance by recreational beach users during high tide roosting periods.

## **1.2 Statement of the Problem**

Few studies have examined the impacts of collaborative conservation on modifying the behaviour of recreational beach users to reduce disturbance rates to roosting migratory shorebirds. This gap in the knowledge will be addressed through the findings of the Space to Roost study that, after a baseline year of research and user engagement in 2016, set aside one of three beaches at a study site as a voluntary ‘Shorebird Resting Beach’, from two hours before and after high tide in August 2017, and again in 2018. The site studied was The Guzzle, which consists of three distinct beach areas separated by dyke walls in the Minas Basin of the Bay of Fundy. The study, of which this thesis forms a part, examined the observed rates of disturbance on migratory shorebirds by recreational beach users during peak high tide roosting periods, comparing 2016, pre-conservation strategy, with those during the conservation strategy in 2017 and 2018, and comparing the Shorebird Resting Beach to the other two beaches. Recreational beach users of interest consisted of all beach users present, broken down into categories based on their behavior, including anglers, sunbathers, birders, photographers, on-leash and off-leash dogs, swimmers, walkers and vehicles.

The findings of this study will help inform decisions surrounding recreational beach use during shorebird migration. Although this research is focused in the Bay of Fundy, the findings may be of utility to conservation managers in other areas where migratory shorebirds stop to rest and refuel. This study will help natural resource managers make better decisions as to how best to control the use of beach areas during peak shorebird migration. The results of the study may be used to improve policy about shorebird conservation.

### **1.3 Primary Research Questions**

The research questions that this thesis seeks to answer are as follows:

1. Did collaborative conservation design and implementation affect shorebird disturbance, and if so, how?
2. What lessons do the pilot test of the co-designed initiative hold for conservation with anglers and other recreational beach users, or collaborative conservation more generally?

### **1.4 Theoretical Framework**

#### **1.4.1 Collaborative Conservation and Human Dimensions of Wildlife Management Theory**

This project employs collaborative conservation theory and human dimensions of wildlife management theory as the first part of its theoretical framework. Collaborative conservation “emphasizes local participation, sustainable natural and human communities and voluntary consent and compliance over enforcement by legal and regulatory coercion” (Wyborn & Bixler, 2013 p. 59 citing Snow, 2001). Collaborative conservation aims to involve stakeholders in an effort to negotiate an acceptable compromise around a contested habitat or wildlife resource, and to “involve the public in a process of collective understanding and learning that will contribute to innovative solutions that serve multiple interests” (Randolph, 2004, cited in Bardati &



Bourgeois, 2008, p.740). The field of human dimensions of wildlife management seeks to improve decision making capabilities by engaging and understanding public motivation (Kerlinger, 1993; Decker, Brown & Mattfeld, 1989; Decker et al., 1992). Researchers of human dimensions study the human behaviours which have negative impacts on wildlife, asking why these behaviours occur and how they might be curbed to reduce or eliminate impacts (Kerlinger, 1993).

#### **1.4.2 Social Normative Theory**

The second part of the project's theoretical framework is social normative theory. Social norms play an important role in determining human behaviours and are useful in dictating how people should behave in a given situation (Brauer & Chaurand, 2010; Cialdini, Reno, & Kallgren, 1990). In otherwise confusing situations, social norms offer a road map by which to understand others' actions and recognize why they are behaving a certain way and how to emulate that behaviour. There are many types of social norms which allow society to function in a mutually agreed upon way. These include civility norms, such as helping elders cross the road or waiting in lines, and norms used to ensure compliance to societal values, like not idling cars or turning off lights when leaving a room (Brauer & Chaurand, 2010). Social norms can be the result of socialization, (e.g. being taught to behave a certain way) (Hoffman, 1970) or observation (Cialdini, Reno, & Kallgren, 1990). Decisions based on observation might differ from situation to situation, depending on whether those observed are peers or friends. Sometimes social norms override personal norms (e.g. changing one's behaviours as a result of peer pressure) (Stern, 2018). It was found in a study of social norms within peer groups that members are affected by peer pressure when their behaviours are not compliant with the norms of the group (Moti & Spiro, 2017). The authors also found that norms that were rejected by society at large were

strictly followed within the peer group. In management settings requiring behavioural change, peer groups can be utilized in such a way that their members adopt the management norms of the conservation strategy, and members of the group subsequently follow the positive behavioural example of their peers. In this way, the peer group will be less likely to demonstrate undesirable behaviours, in fear that this could result in negative interactions with their peer group(s) (Moti & Spiro, 2017; Stein, 2018).

## **1.5 Methods**

To determine: where disturbance was occurring; the use of the site by shorebirds and recreational users; and whether users would be willing to share the site with roosting shorebirds, we employed site audits (Appendix E1, 2) mapping (Appendix E3), in-person surveys (Appendix A), and an on-line survey targeted to recreational anglers (Appendix B).

Baseline site audits were conducted in 2016, to help us understand human and shorebird use at The Guzzle site, including: extent of use by shorebirds; extent of use by recreational users by type; and frequency, scale, cause and locations of shorebird disturbance incidents. Audit methods were adapted from Burger & Niles (2013), Suffolk Coast & Heaths (2012) and Peters & Otis (2007). Audits were conducted during the high tide period, with occurrences of disturbance recorded throughout the audit, and ‘spot checks’ every 30-minutes, which counted total number of coastal users by type, extent of site use by each recreational user type, approximate size of shorebird flocks using the site, and the area in use by shorebird flocks. Shorebird disturbance incidents were monitored and recorded whenever they occurred throughout the audit. A disturbance incident was defined as any time a shorebird walked or flew away from a recreational user, predator, non-predatory bird or unknown source. Instances wherein birds did not land due to human presence or other influences were not counted as a disturbance. Human-

caused disturbances were categorized by recreational user type, number of disturbers, number of birds disturbed and bird behavior (walking away without flying, flying away and returning to the site, and flying away and not returning). Non-human causes of disturbance were also recorded, including predatory birds (predominately Peregrine Falcons), non-predatory birds (i.e. gulls and other shorebirds flying over the flock) and unknown sources (a source of disturbance that was not apparent to the researcher).

The results of the audits from 2016 were used as a baseline to compare with results obtained from similar audits conducted during the ‘Shorebird Resting Beach’ conservation intervention in 2017 and 2018.

## **1.6 Engagement**

Throughout the three-year project, “Space to Roost” planning meetings were held with a group of Minas Basin shorebird conservation project partners. Input was gathered from this group of shorebird experts from Birds Canada, the Wildlife Division of the NS Department of Lands and Forestry (NSDLF), Blomidon Naturalists Society’s IBA Stewardship Committee, Environment and Climate Change’s Canadian Wildlife Service and The Nature Conservancy of Canada, as well as collaborative conservation experts from Dalhousie University. This group met once a year to design methodologies, reflect on successes and challenges, and provide feedback and insight for next steps in the project.

Inputs and insights were also gathered from recreational beach users throughout the study period in the form of verbal surveys. In year one of the study, we surveyed online striped bass anglers, the most numerous group on site, to garner their insights into their use of the site, whether they would be willing to avoid fishing on one of three beaches during high-tide periods in August to

allow for shorebird roosting, and how they thought Space to Roost information would best be communicated to other user groups on site. In 2017, we reached out to 10 users that had expressed interest during our 2016 verbal surveys in helping us reduce disturbance to resting shorebirds. Three responded, supporting the setting aside of one beach for shorebirds, agreeing with our choice of beach to set aside, confirming it was underused by people, and suggesting we get the word out through newsletters, articles in the paper and signage. In 2017, we developed signage and handouts using the recommendations of this group and the anglers who completed the online survey. We included a high-tide chart so that people would know when the birds needed to roost, but also to provide an incentive to keep the card, because Gray & Jordan (2010) recommend combining program information with information of interest to the user group. Throughout the three-year project, informal input from recreational users was gathered on site through researcher engagement between spot-checks, talking about the project, shorebird requirements, and giving handouts to anyone who expressed interest. Handouts were also distributed to local businesses and replenished every two weeks from mid-July to early September.

In 2017 and 2018 we continued to formally survey and informally talk to anglers and other recreational users on site, getting their feedback on our initiatives. Many other avenues for engaging user groups were explored with limited success. We attended an angling derby and set up a booth with our handouts. We led a shorebird beach walk and had a booth at the Kejimikujik National Park Bioblitz. We reached out to hunting and angling groups to request opportunities to present our study at their Annual General Meetings (AGM), with little to no response. We sought a commercial fisherman to serve as a champion for the project, but were ultimately unable to recruit anyone to this role. We held sunset yoga and a shorebird viewing party on the beach in

2017 and planned a similar event in 2018, which unfortunately was rained out. We presented a talk at a local community association meeting, a steering committee meeting and the AGM of the Blomidon Naturalists Society – whose members include many birders and bird photographers – and had a booth at their Citizen Science recruitment event. Finally, we held a presentation for Glooscap First Nation’s Natural Resources team, from whom we requested input and feedback.

Our message outreach extended to the media. In 2018, we gave television interviews with CBC, CTV and Global TV, and conducted tours of the study site to biologists from across the Western Hemisphere Shorebird Reserve Network at the 30<sup>th</sup> Anniversary of the Minas Basin WHSRN designation. We were featured in a documentary film about shorebirds in the Bay of Fundy called *Sharing the Coast with Shorebirds* (refer to acknowledgements for a link to the film). In 2017 and 2018, the Space to Roost handouts and a summary of the project were printed in two local papers and five newsletters with different readerships to try to engage many user groups. In 2018 an article was published in the *Bird Watcher’s Digest*, a periodical based in the USA.

Academic presentations also resulted, albeit at events that included many practitioners. The work was presented in 2017 at the Social Coast Forum in Charleston South Carolina, the Bay of Fundy Ecosystems Partnership Workshop, and the 8th Western Hemisphere Shorebird Group meeting in Panama in 2019.

On balance, many and diverse tactics were used to engage recreational beach users and raise local awareness of the importance of space to roost for shorebirds on local beaches. For this thesis, the focus is on the engagement of anglers, photographers, and other recreational beach users at the Guzzle through an online survey and in-person interviews, on-site signage and pamphlets, and three years of on-site observation of recreational users and shorebird disturbances at three beaches, pre-and post-Shorebird-Resting-Beach establishment.

## **1.7 Assumptions and Limitations**

The research design was carefully developed with the help of a shorebird stewardship committee of senior researchers and experts in shorebird biology, stewardship, and collaborative conservation. Many choices were made to focus the project that may also represent assumptions or limitations worth being aware of at the outset of reading the thesis. For practical purposes, the research team focused the study on the location with the highest numbers of shorebirds and recreational users, determined after a preliminary audit of four sites in the area in 2016 (Evangeline Beach, The Guzzle, Avonport Beach and Blue Beach). Although the birds are present from mid-July to mid-September, August was chosen for monitoring because peak numbers of birds are present at this time, and because of funding constraints for fieldwork. The number of years of the study was also limited to three by funding constraints. Anglers were chosen as the target of the online survey because they were the most numerous users on site, and because it was believed that they would be the most difficult group to convince to avoid disturbing the birds.

Assumptions made during the course of the study included that verbal and online survey answers would be accurate and truthful. This was because their contact details (if they wished to provide them), were written on a separate sheet of paper, and all contact papers were collated at the end of each audit so that no person's responses could be identified. In year one of the study, before the implementation of the Shorebird Resting Beach, there was no audit category for shorebird photographers. It was assumed that photographers would not willingly cause disturbance to the birds, as they come to the site for the birds, and are generally more knowledgeable about the birds' requirements than other user types. They were originally included in the birder category, but they emerged early on as a separate group with different behaviours, and as such, in 2017 we

added a new ‘photographer’ category to our audit datasheets. The author assumed that shorebird photographers would naturally be conservation minded and would be inherently on board for setting aside space to roost for shorebirds. Although the majority did follow this assumption, not all did, and this led to the findings reported in Chapter 3, not originally planned as part of the study.

## **1.8 Organization of the Thesis**

This thesis has been organized into four chapters. The first chapter has provided an introduction, outlining the objectives and scope of the work. Chapters 2 and 3 are intended as draft versions of papers to be submitted to journals for potential publication, and therefore they contain some repetition and overlap with other parts of the thesis, as they will need to stand alone. Chapter 2 presents an overview of the three-year study and its results, with a focus on anglers, the most abundant user group on site, as well as the group believed to be the least likely to change behaviours for the benefit of shorebirds. It compares disturbances by human, non-human and unknown causes, as well as comparisons between human user groups before and after Shorebird Resting Beach establishment. Chapter 3 focuses on the issue of disturbance by photographers, a group that we assumed would be supportive of our conservation initiatives. However, we found that despite there being roughly half the number of photographers on site as both anglers and walkers, photographers caused the second-highest hourly rates of human-caused disturbance on site. The thesis concludes with Chapter 4, which synthesizes and discusses the work as a whole.

## **CHAPTER 2: WORKING WITH ANGLERS AND OTHER RECREATIONAL BEACH USERS TO REDUCE DISTURBANCE TO MIGRATORY SHOREBIRDS DURING HIGH TIDE ROOSTING AT THE GUZZLE, NOVA SCOTIA, CANADA**

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### **2.1 Introduction**

Migratory shorebird numbers have dropped by 54-67% in the Bay of Fundy, Canada since 1997 (Neima, 2016). According to Hicklin (1987), between 50 and 95% of all Semipalmated Sandpipers (*Calidris pusilla*) stop in the Bay of Fundy *en route* to their South American wintering grounds over 4,000-km away (Gratto-Trevor et al., 2012). In a 1984 study, Hicklin et al. found that the food-rich mudflats of the Bay of Fundy supported 800,000-1.2 million Semipalmated Sandpipers during their fall migration, from mid-July to mid-September. *The State of Canada's Birds 2019* reported reductions of 40% of all of Canada's shorebird species since the 1970's (NABCI, 2019). An analysis of Semipalmated Sandpiper population trends (Gratto-Trevor et al., 2012), found that several studies employing different types of trend analyses all found the species had declined in its eastern range (Morrison, Downes & Collins 1994; Hitchcock & Gratto-Trevor, 1997; Aubry & Cotter 2007; Morrison & Hicklin, 2001). However, a reanalysis of these data found that while there was a population decrease from 1985 to 1999, there has been a partial recovery since then (Gratto-Trevor et al., 2012). As a result of its very high ecological value as a shorebird stopover site within the Bay of Fundy, the Minas



Basin is designated as both an Important Bird Area (IBA) of global significance and a Western Hemisphere Shorebird Reserve Network (WHSRN) site of hemispheric importance.

Rest is as important as food to ensure a successful migration (Neima, 2016), so when mudflat foraging areas are covered by water at high tide, shorebirds must find safe places to rest for several hours along the shore. Intense summer recreational pressures at high tide roost sites, such as striped bass angling from the shore, swimming and walking, coincide with peak fall migration in August. Shorebirds' critical energy reserves are depleted when flocks are forced to fly over water for several hours in search of safe roost sites (Mann, 2015). This poses serious risks for shorebirds as they have a short period to obtain adequate energy reserves to complete their long journey south (Helmers, 1992). Without concerted action to reduce high tide recreational pressures, Minas Basin shorebird roost sites may be severely degraded or even lost to shorebirds.

It is increasingly clear that shorebird conservation is necessary, and that conservation must incorporate human values. Conservation planning that integrates and manages competing human values has a greater chance of succeeding because a broader group of stakeholders fosters and sustains the cause (Annis et al., 2017; CMP, 2013; Knight, Cowling & Campbell, 2006; McShane et al., 2011; Milner-Gulland et al., 2014; Wallace, Wagner & Smith, 2016). One group of important stakeholders of interest in the Bay of Fundy is recreational striped bass anglers, who use the same beaches as shorebirds at the same times: peak high tide is best for fishing as well as roosting. Incorporating the values of striped bass anglers into shorebird conservation is essential, as they share beach space with shorebirds and are thus uniquely positioned to be either helpful or harmful. Disturbance to wildlife by the recreational fishery has been well documented, including the trampling of foraging and roosting habitat to gain access to the shore, or through entanglement of wildlife in discarded fishing gear (Laist, 1997).

While recreational fisheries may cause disturbance to wildlife, fishing is not necessarily negative for aquatic habitat structure. Anglers like to fish in quiet, peaceful onshore locations and have been known to collaborate locally to work toward its preservation (Cowx, Arlinghaus & Cooke, 2010). However, it is important to conduct more research on how recreational anglers can be inspired to protect the natural environment that supports their hobby. Other important stakeholders in the Bay of Fundy include birders and photographers and locals and tourists who use beaches to birdwatch, walk and dog walk. This study reports on a pilot application of one approach to working with recreational beach users to encourage them to share their beach spaces with fall migrant shorebirds during high tide periods in August.

The conventional way most conservation groups seek to change the behaviours of recreational beach users that harm wildlife is by delivering information about species decline and ways to help. Although this was a part of our strategy, our approach was more fulsome and included several other methods, which will be described in more detail in the methods section. Gray and Jordan (2010, p. 242) found that, in the case of anglers, “recreational fishers are overwhelmingly open to receiving information about behaviors that can minimize their impact on the marine fisheries they value.” This openness could perhaps be extended to shorebirds and their habitat, since habitat conservation likely sustains the fishery in addition to benefiting other species. Other recreational user groups might be similarly open to receiving information that can minimize impacts to the beaches they value.

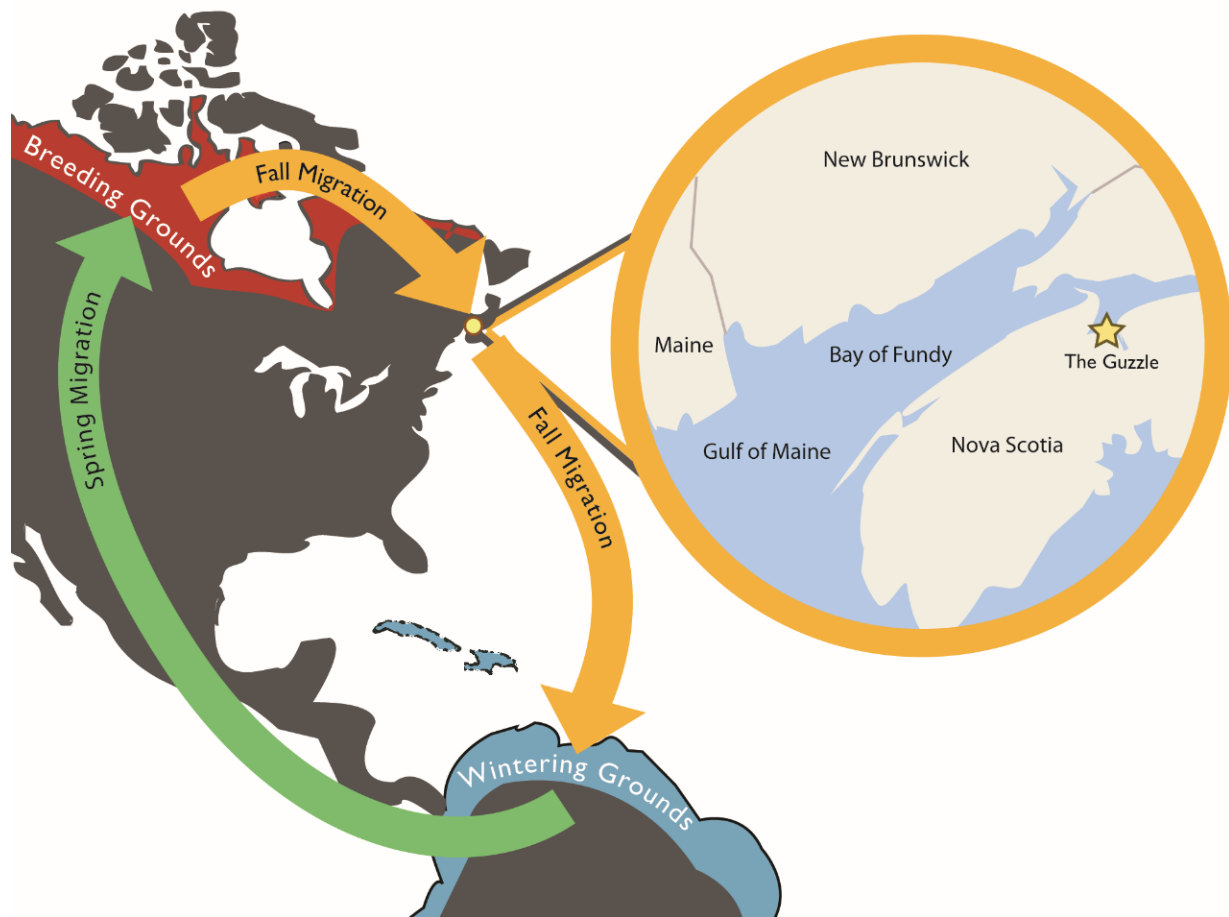
It is important to remember that simply providing users with information, and assuming that ‘bad’ behaviour is solely the result of a lack of knowledge, often referred to as the ‘deficit model’ of behaviour change (Gray & Jordan, 2010; Hart & Nisbet, 2012; Sturgis & Allum, 2004; Ziman, 1991), tends not to lead to behaviour changes that are in-line with management

objectives (Gray & Jordan, 2010). Indeed, Sturgis & Allum (2004) found that “prior beliefs and values have more influence on behavior than simply providing audiences with new information” (cited in Gray & Jordan, 2010, p.243). Therefore, trying to change people’s behaviour when they do not inherently believe or value the change is challenging. Attempts to change behaviours through knowledge transfer can also lead to a boomerang effect, whereby users instead engage in the opposite behaviour of those in line with management objectives (Hart & Nisbet, 2012). Gray & Jordan (2010) recommended a combination of methods be deployed in tandem to try to curb behaviour. They gave four recommendations for modifying user behaviour, including (illustrated with possible examples for our case): 1) justifying behaviour recommendations within both ecological and management contexts so that users understand why they are being asked to modify their behaviour; 2) addressing any perceived threats users feel the conservation measures might have on their freedoms to use the beach as they wish; 3) combining program information with information of interest to the user group, such as alternate non-beach locations to walk dogs, or information about the dykelands for tourists; 4) making printed materials available online and in resources that users will see and use throughout the time period of interest, such as the annual Nova Scotia Anglers’ Handbook, tourist magazines, or local birding guides.

Anglers, birders and photographers are often great sources of local ecological knowledge, as they spend many hours observing nature. By bringing these user groups in on conservation from project inception, asking their opinions about what strategies they think might work, and listening to what they have learned through observation about shorebirds and their habitat, we can not only learn more about the species we wish to conserve and the prior beliefs and values of the groups, but perhaps also indirectly motivate and encourage them to be better stewards of shorebird habitat. If a rapport is established and trust built, many different recreational user

groups may be more open to understanding the role that shorebirds play as indicators of ecosystem health, more willing to shift their behaviours from those that disturb beach habitat and the birds that depend on it, and more open to allocating resources toward habitat restoration. As an example of a successful innovative approach at a shorebird migration stopover site in New Jersey, Burger & Niles (2013) found positive impacts through partnerships with recreational beach users. Understanding the communities of users and engaging individuals in the process of discussing and developing conservation solutions can have positive impacts on the success of interventions. Biodiversity conservation requires input from local people, and when they are not taken into consideration, the long-term success rates of conservation measures implemented by governments and NGO's have been found to be low (Kothari, Camill & Brown, 2013).

This chapter presents the results of a pilot program of collaborative conservation design and implementation at a site called The Guzzle (Figure 1), to support Shorebird Resting Beaches during migration. Chosen as a result of shorebird disturbance audits in 2016, The Guzzle is a popular site for striped bass anglers, as well as birders, photographers, locals and tourists from July to September, when peak numbers of migratory shorebirds are present and significant disturbance occurs.



**Figure 1:** The yellow star (see inset) denotes The Guzzle study site, located in the Minas Basin, Bay of Fundy, Nova Scotia, Canada, and the yellow dot denotes the relationship of the site to the hemispheric fall migration of the Semipalmated Sandpiper and other shorebirds. During their spring migration, they stop in Delaware Bay to feed on horseshoe crab eggs (Burger et al., 2004). Design credit: Fahey, J. 2016

The sections that follow present the processes of designing, piloting and comparatively assessing impacts from 2016-2018, and seek to answer the following research questions:

1. Did collaborative conservation design and implementation affect shorebird disturbance, and if so, how?
2. What lessons do the pilot test of the co-designed initiative hold for conservation with anglers and other recreational beach users, or collaborative conservation more generally?

## **2.2 Methods**

This project employs collaborative conservation, human dimensions and social normative theory as its theoretical frameworks. Collaborative conservation “emphasizes local participation, sustainable natural and human communities and voluntary consent and compliance over enforcement by legal and regulatory coercion” (Wyborn & Bixler, 2013 p. 59 citing Snow, 2001). It aims to involve stakeholders in an effort to negotiate an acceptable compromise around a contested habitat or wildlife resource, and “involve the public in a process of collective understanding and learning that will contribute to innovative solutions that serve multiple interests” (Bardati & Bourgeois, 2008 p.740 citing Randolph, 2004).

Approaches in the field of human dimensions of wildlife management seek to improve decision making capabilities by engaging and understanding public motivation (Kerlinger, 1993; Decker et al., 1989; Decker et al., 1992). Researchers of human dimensions study the human behaviours that have negative impacts on wildlife, asking why these behaviours occur and how they might be curbed to reduce or eliminate impacts (Kerlinger, 1993).

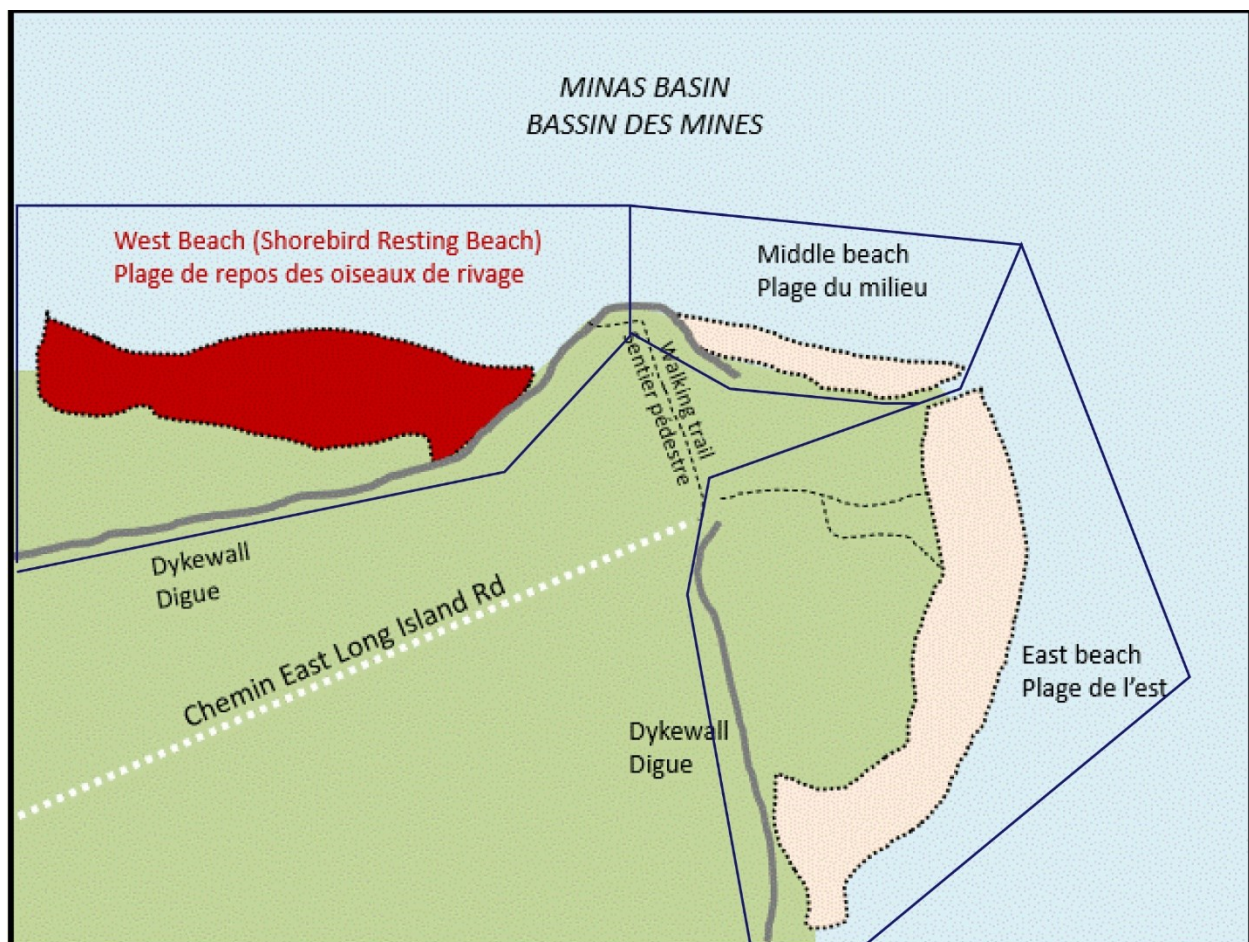
Social normative theory helps to determine human behaviours and is useful in understanding how people will and feel they should behave in a given situation (Brauer & Chaurand, 2010; Cialdini, Reno, & Kallgren, 1990).

### **2.2.1 Choosing the Study Area**

The Bay of Fundy is part of the Gulf of Maine, located between Nova Scotia and New Brunswick in Canada, and Maine in the United States. Semipalmated Sandpipers and other fall migrants use the Bay of Fundy as a staging area during their migration from the Arctic to South America, and it has been classified as "the most important site for the species in eastern North America" (Morrison, 1977 p. 193 as cited in Hicklin & Smith, 1984 p. 2201).

With increasing competition for coastal beach access by recreational users, shorebird disturbance in the Minas Basin has become a problem that may be solved by incorporating human recreational needs into conservation solutions. In 2016, four sites in the Minas Basin were identified by Birds Canada—in collaboration with Nova Scotia Department of Lands and Forestry's Wildlife Division, Blomidon Naturalists Society's IBA Stewardship Committee, and Environment and Climate Change Canada's Canadian Wildlife Service—as sites where shorebirds were being disturbed during high tide roosting by recreational users. These sites were audited in 2016 for bird disturbance and their causes (more discussion later), and beach users were surveyed to find out where they were travelling from, why they were visiting the sites, what they knew about the value of the sites to shorebirds, and whether they would be interested in learning more about the project and/or getting involved in finding and implementing solutions. Based on the audits and surveys, two of the four sites were chosen as pilot sites for implementing conservation strategies because they had the largest numbers of shorebirds, the highest rates of disturbance, and the most potential for buy-in from local users. This paper focuses on one of

those two sites, The Guzzle (Figure 2), comprised of three beaches, (West, Middle and East, with abutting dykelands), near Grand Pré, Nova Scotia, all of which are popular with recreational users. It is also a popular tourist destination, as people come to see the UNESCO World Heritage-designated agricultural dykes and dykelands which flank the three beaches (called the UNESCO *Landscape of Grand Pré*). The dykes also serve as popular walking, dog walking, birdwatching and biking paths for tourists and locals.



**Figure 2:** The three beach sections of The Guzzle, NS Canada, used on bilingual signage (English and French), denoting the West Beach (in red) as the Shorebird Resting Beach. Blue polygons delineate the sections, including beaches and abutting dykwalls. Design credit: Fahey, J. 2016



### **2.2.2 Baseline disturbance audits**

In this study, we employed site audits (Appendix E1, 2) and maps (Appendix E3), in-person surveys with randomly selected recreational beach users (Appendix A), and an on-line (Facebook) survey targeted to striped bass anglers (Appendix B), the most numerous user group on site. These tools were used to determine the use of the site by shorebirds and recreational users, where disturbance was happening, and whether users would be willing to change their behaviours to share the site with roosting shorebirds. In 2016, baseline site audits were conducted ten times from August 1st to September 10<sup>th</sup>, centred around the high tide, with roughly equal distribution of morning, afternoon and evening high tides, for a total of for 24.5 hours of effort. These audits and maps helped us to understand key elements of human and shorebird use at the roost site including: extent of use by shorebirds; extent of use by recreational users of different types; and frequency, scale, cause and locations of shorebird disturbance incidents. The three Guzzle beaches and abutting dykelands were each monitored as a separate section (Figure 2). Site audit methods were adapted from Burger & Niles (2013), Suffolk Coast & Heaths (2012) and Peters & Otis (2007). Site audits were conducted during the high tide period—two hours before to two hours after high tide—with occurrences of disturbance recorded throughout the audit, and ‘spot checks’ every 30-minutes. Spot checks were used to count the total number of coastal users by type, the extent of use of each site by each recreational user type, the approximate size of shorebird flocks using the site, and the area in use by shorebird flocks.

The audits also counted types of coastal users, including walkers, walkers with on-leash or off-leash dog(s), on-shore anglers and their number of fishing rods (many operate more than one at a time), photographers, birders, swimmers, sunbathers, vehicles (including bicycles and vehicle

sounds), and boaters. These audits were used to calculate the numbers, types and timing of human use during high tide periods during peak fall shorebird migration, delineate areas of the site the shorebirds use, and identify areas of human-shorebird overlap and/or conflict. The results of the audits from 2016 were used as a baseline to compare with results obtained from similar audits conducted during the ‘Shorebird Resting Beach’ conservation intervention in 2017 and 2018.

Incidences of shorebird disturbance were monitored and recorded whenever they occurred throughout the audit. A disturbance incident was classified as any time a shorebird walked or flew away from a recreational user, predator, non-predatory bird or unknown source. Often the shorebirds would flush (fly away), and then return to the beach multiple times from a single source of disturbance, which we counted separately. Shorebird-human avoidance, whereby birds did not land due to human presence or other influences, was not counted as a disturbance. Human-caused disturbances were categorized by recreational user type, number of disturbers, number of birds disturbed, bird behavior. Non-human causes of disturbance were also recorded, including predatory birds, non-predatory birds and unknown sources.

### **2.2.3 Collaborative conservation design**

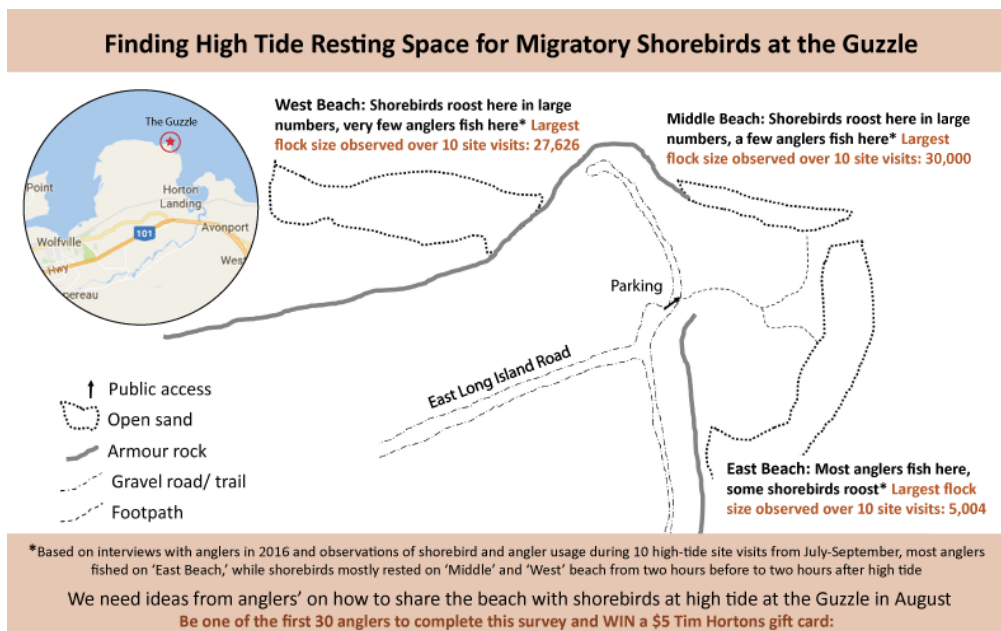
In addition to the observation of site use and bird disturbance by recreational users, verbal surveys (Appendix A) were employed to find out the distance beach users travelled to get to the site, why they chose the site, what they knew about the value of the site to shorebirds, and if they would be interested in learning more about the project, and/or getting involved in finding and implementing solutions to bird disturbance. Recreational users were approached randomly and asked to complete a short 15-minute verbal survey, the answers to which the researcher

paraphrased by hand. The surveys were adapted from Burger & Niles (2013) and approved by the Dalhousie Research Ethics Board (REB # 2016-3950).

Of the 17 surveys carried out in 2016, 14 were completed by striped bass anglers, by far the largest beach user group on site. Anglers—like the shorebirds—display high site fidelity, and as a result, anglers are well placed to be excellent shorebird ambassadors, monitoring sites and teaching others about the importance of allowing them time to roost at high tide. In order to assess anglers' interest in shorebirds, and their interest in changing their behaviours to benefit shorebirds, a nine-question online survey (Appendix B) was developed to gather their ideas on whether and how they (and other anglers) might be willing to share The Guzzle with shorebirds at high tide during peak shorebird migration. We offered a \$5 gift card from a popular coffeeshop chain (Tim Horton's) and a personalized letter (Appendix B5) as a token of appreciation for participating in the survey. The survey was approved for use by the Dalhousie Research Ethics Board (REB # 2017-4219). We originally considered hosting a focus group of anglers, however, after surveying them at our four sites in 2016, we realized that the logistics for a focus group were impractical. People come from all over the province (and beyond) to fish at these locations, most anglers surveyed said they would not be interested in going to a focus group, and, a striped bass expert at Acadia University in Wolfville NS, Dr. Avery, thought that getting the word out and garnering enough interest to get a sufficiently large group would be challenging. With insight and input from Dr. Avery and his Striped Bass Research Team, we created a Facebook survey and distributed it to fishing and angling Facebook groups, as well as on our own Facebook page (Appendix B2). There was one Facebook user, the president of an Angling Association in the nearby province of New Brunswick, who responded to our call on Facebook, stating that he thought we were aiming to close the beach to anglers entirely

(Appendix B3). His position of authority within the angling community may have influenced others not to complete the survey, and there is no way of knowing how many, if any, he may have influenced.

We received 22 responses, with 15 reporting that they fish at The Guzzle, five that they fish at other locations in Nova Scotia, and two who declined to report where or even whether they fish striped bass. Participants were asked if they would be willing to fish only on the East and/or Middle beach (the most heavily used), leaving the West and/or Middle beaches for the shorebirds (Figure 3).



**Figure 3:** The Guzzle beach map used in the online angler survey. Anglers were asked to identify which (if any) of the beaches they would be willing to set aside for shorebirds at high tide in NS, Canada.

Of the 15 respondents who reported fishing at The Guzzle, nine said they would be willing to fish on East beach only, four said they would want to fish on both East and Middle beaches, and two said they would want to fish on all three beaches (Appendix B4). The majority of

respondents (18), believed that signage would be the best way to communicate that certain beaches were being set aside for birds. Another five felt that sharing the information would be most effective in the Nova Scotia Anglers' Handbook, through the Striped Bass Association, and through tourist sites. Four each believed that face-to-face communication and social media were best, and two felt that the most effective way to reach people would be through local newspapers (Appendix B4).

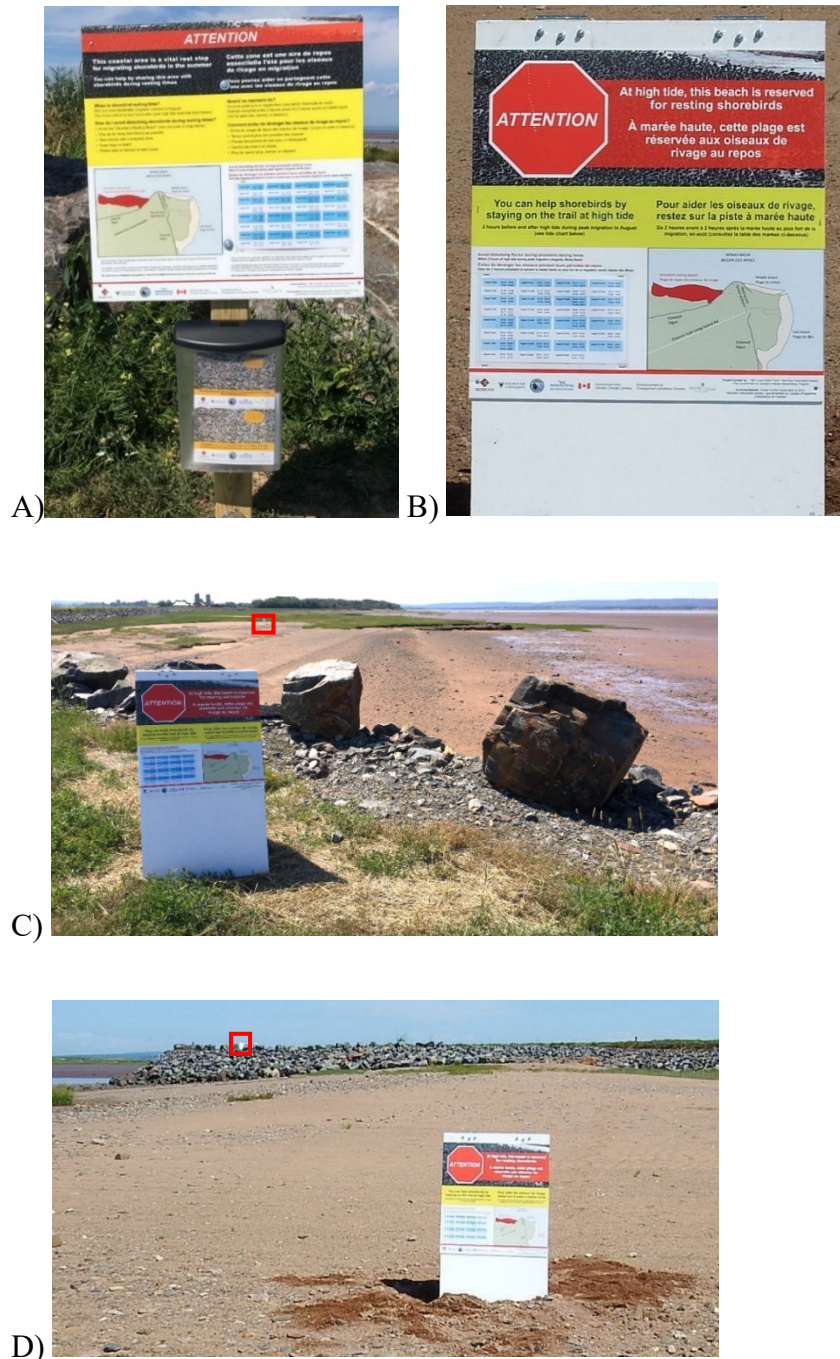
#### **2.2.4 Conservation Pilot**

Results from the baseline disturbance audits, in-person surveys and online survey directly informed the development and piloting of conservation strategies at roost sites to reduce shorebird disturbance and habitat degradation during fall migration in 2017 and 2018.

In the spring of 2017, West Beach was chosen to be piloted as a high tide 'Shorebird Resting Beach'. The choice of West Beach was based on results from the online survey suggesting the majority of participating anglers were willing to leave West Beach for the shorebirds at high tide, as well as from the site audits indicating that West Beach had the most shorebirds present and the fewest human users. A conservation strategy was developed whereby beach users were asked to voluntarily leave the Shorebird Resting Beach exclusively for shorebird use during high tide in August. An anchored sign was placed at the entrance to The Guzzle (Figure 4A, Appendix D4), identifying the site as a vital shorebird resting stop, explaining the importance of high tide resting time to shorebirds and how users can help, providing a map of the location and extent of the Shorebird Resting Beach, and a high tide chart detailing exactly when shorebirds need rest (the specific times delineating two hours before and after high tide each day in August; Appendix D5). All of the information was presented in English and French (Canada's two official languages). Manning (2003) found that messages at the entry of a site should be limited to just a

few points, but in requiring both official languages, we found brevity a challenge, and despite trying to reduce the word count in 2018, we ended up using the same signage, minus one sentence. Sandwich-board signs were also placed at either end of the Shorebird Resting Beach in both years, with similar content (Figure 4B, C, D, Appendix D). We placed signs as close to the Shorebird Resting Beach as possible, as Sussman & Gifford (2012) found that signage is more effective when it is placed in close proximity to the location where the desired behaviour change is intended to occur.

A waterproof pamphlet box was affixed to the bottom of the anchored sign to hold English and French handouts (Appendix C, D1) detailing ‘how to help’ messaging for high tide roost sites, project information and a tide chart (to motivate users to refer to it throughout the summer). Handouts were also distributed on site and to local businesses, tourist attractions and the tourist bureau, and restocked throughout the month of July and August. Over the three years of the study, 2,300 English and 594 French handouts were distributed.



**Figure 4:** Seasonal on-site A) anchored and B) sandwich-board signage identifying The Guzzle, NS Canada, as vital shorebird roosting habitat, asking users to avoid the beach from two hours before and after high tide in August, including perspectives on the latter from C) atop the dyke, which runs the length of West Beach (Shorebird Resting Beach in 2017 and 2018), and D) on the West Beach; photos C and D indicate the other position using a red square. (Refer to Appendix D for larger versions of the signage).

### 2.2.5 Measuring Conservation Impact

To assess the impact of the conservation pilot for two years post-Shorebird Resting Beach establishment, the site was audited from August 1-31<sup>st</sup>: 15 times in 2017 for a total effort of 55 hours, and 12 times in 2018 for a total effort of 42.5 hours (Table 1), using the same method as the baseline audits in 2016 (as in 2.2.2). Verbal surveys were employed at the Guzzle in all three years (Appendix A), with 69 surveys conducted in total.

To get a sense of how successful the Shorebird Resting Beach was in reducing disturbance to shorebirds during high tide roosting periods, we compared disturbance across the three years of the study (2016-2018), as well as the three beach sections of The Guzzle (West Beach, Middle Beach and East Beach). To account for differences in audit effort from year to year, we calculated an hourly rate of disturbance by dividing the number of disturbances by number of audit hours, since disturbance was counted throughout the audit, and we calculated both a rate of human and shorebird presence by dividing number of human users (by type) or number of shorebirds, by the number of spot checks per year, since numbers of humans and birds were counted during each 30-minute spot check (Table 1, 2 & 3).

**Table 1:** Audit effort by year, including total number of audits, total number of audit hours and total number of spot checks at The Guzzle, NS Canada.

<b>Audit Effort</b>			
<b>Year</b>	<b>Audits</b>	<b>Audit Hours</b>	<b>Spot Checks</b>
2016	10	24.5	56
2017	15	55	125
2018	12	42.5	96
<b>Total</b>	<b>37</b>	<b>122</b>	<b>277</b>



## 2.3 Results

Shorebird disturbance at The Guzzle had both human and non-human causes. As it is difficult to control the non-human causes, this project focused on reducing human-caused disturbance. Results of the audit are first presented, beginning with the number of shorebirds on site in each year and beach section. To get a sense of how human-caused disturbance compared to non-human caused disturbance, the number and rate of birds disturbed by human-causes will be compared to non-human and unknown causes on all beaches and years. The number and rate of human-caused disturbance by individual human user types will then be examined on all beaches and years. Next, the ratio of human users present who chose to avoid going down to the West Beach (Shorebird Resting Beach) from the dyke above will be examined. The results of the verbal surveys are subsequently reviewed, including 2017/2018 responses to questions about whether users had done anything differently than years previous, and a follow-up question about whether they had seen our signs/handouts.

### 2.3.1 Shorebird presence

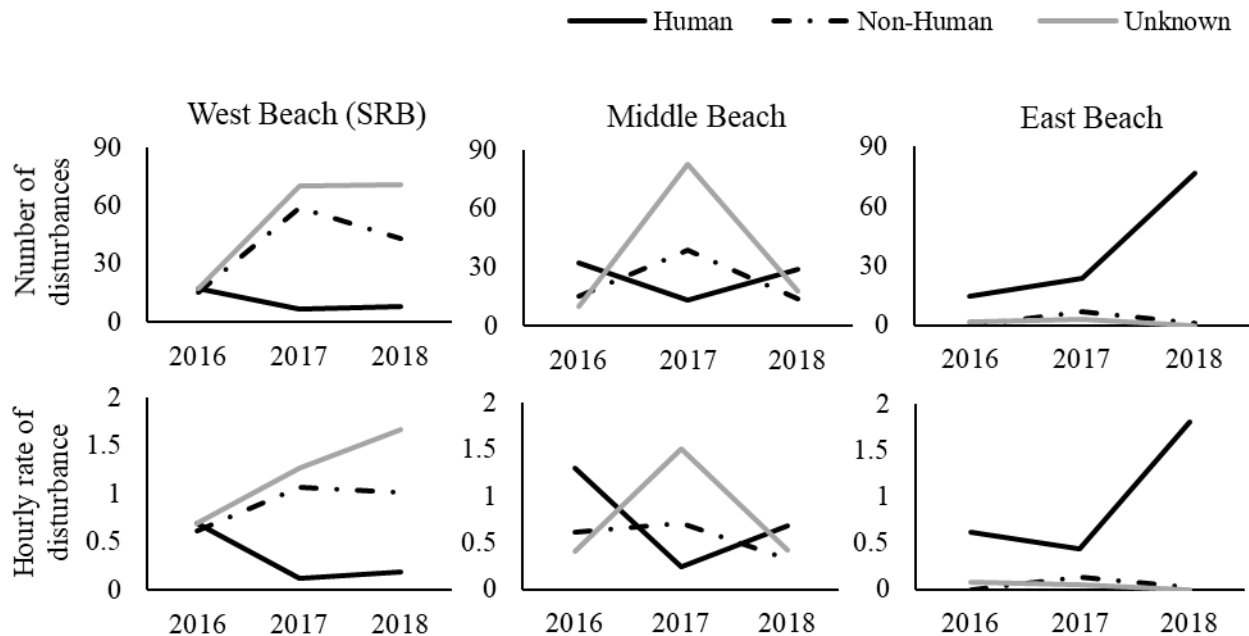
West Beach, which became the Shorebird Resting Beach in 2017 and 2018, had the highest rates of shorebird presence of all three beaches in each year, while East Beach had the lowest (Table 2). On both West and East Beaches, 2017 had the lowest numbers and rates of birds present, while 2018 had the lowest on Middle Beach. In 2016 and 2017, West and Middle Beaches had very similar numbers of shorebirds present, but in 2018 there were roughly three times more birds present on West Beach than on Middle.

**Table 2:** A) Number of shorebirds and B) Rate of shorebirds (number of shorebirds divided by number of spot checks/year (Table 1)) present by year and beach section at The Guzzle, NS Canada.

	Number of shorebirds present			Rate of shorebirds present		
	2016	2017	2018	2016	2017	2018
<b>West Beach</b>	60,755	35,191	40,551	1,084.91	281.53	422.41
<b>Middle Beach</b>	56,904	34,775	13,970	1,016.14	278.20	145.22
<b>East Beach</b>	2,220	1,358	4,916	39.64	10.86	51.21
<b>Total</b>	<b>119,879</b>	<b>71,324</b>	<b>59,437</b>	<b>2,140.69</b>	<b>570.59</b>	<b>618.84</b>

### 2.3.2 Differences in human, non-human and unknown causes of disturbance across beaches and time

On the West Beach, the highest number and hourly rate of human-caused disturbances were in 2016, pre-conservation strategy (Figure 5). In 2017, after the implementation of the Shorebird Resting Beach, the number and rate of human-caused disturbances decreased, before increasing slightly in 2018. In contrast, the numbers and rates of non-human disturbances showed a marked increase from 2016 to 2017, dipping slightly in 2018, but remaining well above 2016 levels. The number and hourly rate of disturbances from unknown sources increased dramatically from 2016 to 2017. In 2018, the number increased very slightly, almost leveling off, while the hourly rate continued its linear increase from 2016.



**Figure 5:** Number and hourly rate of disturbance to shorebirds by year and beach section, comparing total human causes from all categories (anglers, birders, boaters, off leash dogs, on leash dogs, photographers, walkers and vehicles), to non-human (predatory and non-predatory birds) and unknown causes (source of disturbance could not be determined).

On Middle Beach, in all three years, disturbance by humans was higher than on West Beach, with the highest number and rate of disturbance in 2016 and lowest in 2017. The smaller number of disturbances on West Beach in 2016 was one of the reasons we chose it as the Shorebird Resting Beach, as it was the ‘low hanging fruit’ between the beaches. In 2018, the number of disturbances on Middle Beach increased to nearly 2016 levels, and while the rate increased with a similar slope, it did not reach its more dramatic 2016 levels. Both the number and rate of non-human disturbances were higher on West than on Middle in 2017 and 2018. As on West Beach, the number and rate of unknown disturbances was lowest in 2016, but unlike West, both number and rate increased dramatically and peaked in 2017, before decreasing to almost 2016 levels in 2018.

East Beach had a similar number and rate of human caused disturbances in 2016 to that of West Beach. On West, the number and rate was lower in both 2017 and 2018 than in 2016, and the rate of disturbance on East followed this pattern in 2017, but then increased dramatically in 2018. Meanwhile, the number of disturbances on East increased from 2016 to 2017 and then followed the steep rate trajectory from 2017 to 2018. Non-humans caused lower numbers and rates of disturbances on East Beach than West Beach in all years, though 2017 peaked close to those of West. Unknown rates were much lower on East Beach than on West in all years. Number of disturbances peaked in 2017, while rate peaked in 2016.

### **2.3.3 Human caused disturbances by user type across beaches and time**

In 2016, 85 recreational beach users were counted in the West Beach section of the study area, including anglers (n=25), photographers (n=18), walkers (n=18), birders (n=16) and dog walkers (n=8) (Table 3C). These users caused seventeen disturbances, including fourteen by walkers and three by a photographer (Table 3A). The total numbers of audited users in the West Beach section (beach and dyke) increased dramatically to 152 and 292 in 2017 and 2018, respectively, with most of these being birders, photographers and walkers. Notably, however, the numbers of anglers decreased from 25 in 2016 to 4 and 3 in 2017 and 2018, respectively. The number of disturbances by all user types also decreased, down from 17 in 2016 to seven and eight in 2017 and 2018. In 2018, all user types were present, but the disturbances were due to three anglers and the sound of a farm vehicle starting up adjacent to the study area (Table 3A). Accounting for the difference in number of hours of audit effort between years (Table 1), we found decreases in the hourly rate of human-caused disturbance of 82% and 73% from 2016 to 2017 and 2018 respectively (Table 3B).

**Table 3:** Comparing human-caused disturbance pre-conservation strategy (2016) to post-conservation strategy (2017, 2018) on all three beaches (A) Number of human-caused disturbance incidents by disturbance type (B) Hourly rate of human-caused disturbance (number of disturbances (by user type) divided by number of audit hours per year (Table 1) (C) Number of human users on beaches and dykes by section (See Figure 2 for section delineation) (D) Rate of human users (number of users (by user type)) divided by number of spot checks per year at The Guzzle, NS Canada.

		A) Number of shorebird disturbances			B) Hourly rate of disturbance			C) Number of human users on beaches and dykes by section			D) Rate of human users on beaches and dykes by section		
		2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
West Beach (SRB)	Angler	0	0	5	0	0	0.12	25	4	3	0.45	0.03	0.03
	Birder	0	0	0	0	0	0	16	30	94	0.29	0.24	0.98
	Boater	0	0	0	0	0	0	0	1	5	0	0.01	0.05
	Dog walker	0	0	0	0	0	0	8	2	13	0.14	0.02	0.14
	Photog	3	6	0	0.12	0.11	0	18	44	87	0.32	0.35	0.91
	Vehicle	0	0	3	0	0	0.07	0	4	2	0	0.03	0.02
	Walker	14	1	0	0.57	0.02	0	18	67	86	0.32	0.54	0.90
	<b>Total</b>	<b>17</b>	<b>7</b>	<b>8</b>	<b>0.69</b>	<b>0.13</b>	<b>0.19</b>	<b>85</b>	<b>152</b>	<b>292</b>	<b>1.52</b>	<b>1.22</b>	<b>3.04</b>
Middle Beach	Angler	9	12	5	0.37	0.22	0.12	32	29	12	0.57	0.23	0.13
	Birder	2	0	0	0.08	0	0	16	13	39	0.29	0.10	0.41
	Boater	0	0	3	0	0	0.07	0	4	7	0	0.03	0.07
	Dog walker	1	0	1	0.04	0	0.02	2	0	5	0.04	0	0.05
	Photog	7	1	19	0.29	0.02	0.45	18	40	44	0.32	0.32	0.46
	Vehicle	0	0	0	0	0	0	0	2	4	0	0.02	0.04
	Walker	13	0	1	0.53	0	0.02	16	56	62	0.29	0.45	0.65
	<b>Total</b>	<b>32</b>	<b>13</b>	<b>29</b>	<b>1.31</b>	<b>0.24</b>	<b>0.61</b>	<b>84</b>	<b>144</b>	<b>173</b>	<b>1.50</b>	<b>1.15</b>	<b>1.80</b>
East Beach	Angler	7	18	28	0.29	0.33	0.66	111	161	114	1.98	1.29	1.19
	Birder	0	0	1	0	0	0.02	2	5	5	0.04	0.04	0.05
	Boater	0	0	0	0	0	0	1	9	1	0.02	0.07	0.01
	Dog walker	0	1	3	0	0.02	0.07	1	8	4	0.02	0.06	0.04
	Photog	0	4	17	0	0.07	0.40	0	13	16	0	0.10	0.17
	Vehicle	0	0	0	0	0	0	0	1	0	0	0.01	0
	Walker	8	1	28	0.33	0.02	0.66	37	39	24	0.66	0.31	0.25
	<b>Total</b>	<b>15</b>	<b>24</b>	<b>77</b>	<b>0.61</b>	<b>0.44</b>	<b>1.81</b>	<b>152</b>	<b>236</b>	<b>164</b>	<b>2.71</b>	<b>1.89</b>	<b>1.71</b>

As was the case with West Beach, the numbers of anglers on Middle Beach declined, though not as dramatically, from 2016 to 2017 and 2018, even as the number of total users increased. When comparing Middle and West Beach in 2016, pre-conservation strategy, Middle Beach had an overall hourly rate of disturbance by all human user groups that was nearly twice as high as for West Beach (47%). This pattern continued in 2017 (46%) and increased to three times (69%) the hourly rate of disturbance of West Beach in 2018.

On East Beach, both the numbers of anglers and total numbers of all recreational user types increased from 2016 to 2017, and then relaxed back down to almost as low as 2016 levels in 2018. Pre-conservation strategy the hourly rate of disturbance on West Beach in 2016 was 12% higher than on East Beach. However, while hourly rates of disturbance dropped on West Beach in subsequent years, this was not the case on East Beach. The combined hourly rate of disturbance by all human user groups was nearly 3.5 times (71%) and 9.5 times (90%) higher in 2017 and 2018, respectively, on East Beach than on West Beach. East Beach had high hourly rates of disturbance by anglers and walkers in 2016 and 2018, with 2018 rates for these user groups approximately double those of 2016.

The overall number and hourly rate of birds disturbed by humans on the Shorebird Resting Beach decreased from pre-conservation to post-conservation strategy. Further, Middle Beach and East Beach both exhibited higher hourly rates of disturbance than West Beach in post-Shorebird Resting Beach years; 2017 and 2018, with nearly three times the hourly rate of disturbance in 2018. Pre-conservation strategy, the Shorebird Resting Beach had disturbance rates that were nearly half as high as Middle, which dropped relative to Middle in 2018. The Resting Beach was also nearly 3.5 times lower than East in 2017, and 9.5 times lower in 2018. Pre-conservation disturbance rates showed that the Resting Beach had 12% higher rates of human-caused

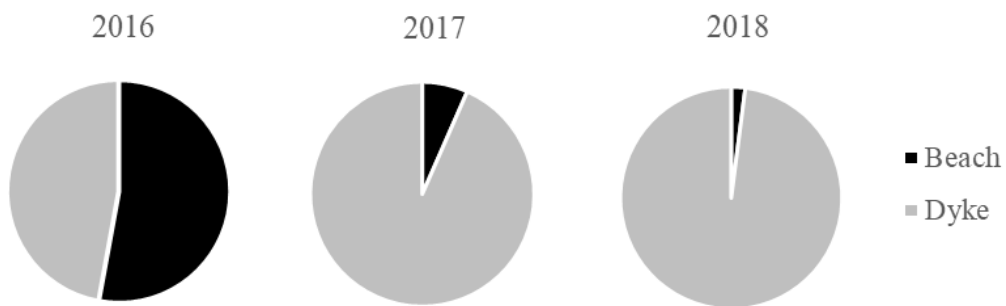
disturbance than East, followed by a substantial drop on the Resting Beach compared to East in both 2017 and 2018. In terms of individual users observed on the Resting Beach, only a photographer, three anglers, the sound of a vehicle, and a walker caused disturbance in 2017-2018. The Resting Beach had a lower hourly rate of disturbance by anglers in 2017 than on Middle Beach, and an equal rate in 2018. Finally, the Resting Beach had lower rates of disturbances by anglers than on East Beach in both 2017 and 2018. These various statistics suggest that the approach is a promising one.



### 2.3.4 Observed behaviour

The numbers of users on the beach versus the dyke portions of the study sites were not counted for any of the three sections (West, Middle, East). However, the numbers of beach versus dyke users were later able to be extracted for the West Beach section from our maps during data analysis (Appendix E3).

The observed hourly rate of users on the dyke above who chose to go down to the Shorebird Resting Beach (despite signage on each end of the beach) decreased from 53% in 2016 (Figure 6) to 6.6% in 2017, and 2.1% in 2018.



**Figure 6:** (Beach vs Dyke) Differences in the ratio of users choosing to stay on the dyke rather than go down to the beach in the Shorebird Resting Beach section. Pre-conservation intervention in 2016 versus post conservation intervention in 2017 and 2018, when the West Beach became the Shorebird Resting Beach at the Guzzle, NS Canada.

Despite differences in audit effort between years, the presence of the sandwich board signs on either end of the beach, coupled with researcher presence, seems to have drastically reduced the ratio of users choosing to go down to the beach from 2016 to 2017, and further reduced it in 2018, despite the number of site users doubling from 2016 to 2018 (Table 4).

**Table 4:** Number and rate (Table 1) of site users on the dyke, the beach, and both the dyke and beach at the West Beach (Shorebird Resting Beach) section by year at The Guzzle, NS Canada.

	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Number of site users on the dyke</b>	40	142	286
<b>Number of site users on the beach</b>	45	10	6
<b>Total number of site users on both the dyke and beach</b>	85	152	292
<b>Rate of site users on the dyke</b>	0.71	1.14	2.98
<b>Rate of site users on the beach</b>	0.80	0.08	0.06
<b>Total rate of site users on both the dyke and beach</b>	1.52	1.22	3.04

### 2.3.5 Verbal surveys

In-person, verbal surveys were conducted pre-and post-conservation strategy in 2016, 2017 and 2018 at The Guzzle. In 2016, pre-conservation strategy, 17 verbal surveys were conducted, with interviewees indicating their top reasons for visiting as angling for striped bass (n=13), followed by bird watching (n=2). In 2017, during the pilot Shorebird Resting Beach year, 24 verbal surveys were conducted, with interviewees indicating their top reasons for visiting as bird watching (n=7), followed by angling (n=5) and bird photography (n=4). In 2018, 28 verbal surveys were completed, with the majority of respondents identifying as anglers (n=12), followed by walkers (n=5) and bird photographers (n=3).

In 2017, we asked 24 people if they had done anything differently that year than in years past. Only one interviewee, a photographer, answered ‘yes’ (4%), following up by saying that because of the signs and our presence they did not go down to the ‘Shorebird Resting Beach’ to take

photographs like they normally would. Thirteen interviewees (54%) said they had not done anything differently that year, but four of those mentioned they had seen our signs, and two said they had always been careful to stay away from the birds. The remaining 10 (42%) respondents had not been to the site in a previous year (Table 5). The question “Have you done anything differently this year than in years previous,” may have been too ambiguous, as it also elicited responses like “We brought snacks this year”. After receiving similar responses several times, we began to follow it up by asking if they noticed the signage or handouts and if they were aware of the importance of the location to shorebirds. We received ten responses to this follow-up question. Eight (54%) of the 13 people who said they did not do anything differently in 2017/2018 than in years previous, did say they noticed our signs.

**Table 5:** Survey results pre-and post-conservation strategy at The Guzzle, NS Canada. Balance of responses after ‘yes’ and ‘no’ is ‘I don’t know’ or \*‘Not applicable’ because they had never been to the site before that year.

Question	% Pre-Conservation Strategy (2016) n=17		% Post-Conservation Strategy (2017) n=24		% Post-Conservation Strategy (2018) n=28	
	Yes	No	Yes	No	Yes	No
<b>Have you noticed shorebirds in the area when you are here?</b>	100%	0%	96%	4%	93%	7%
<b>Did you know the importance of the spot to migrating shorebirds?</b>	47%	53%	88%	12%	64%	36%
<b>Do you think shorebirds are threatened here?</b>	18%	59%	38%	25%	Not Asked	Not Asked
<b>*Have you done anything differently this year than in years past?</b>	Not asked	Not asked	4%	54%	Not Asked	Not Asked

All but one of the 24 respondents in 2017 were aware that shorebirds use the site, 21 knew the site was important to migrating shorebirds, and nine believed them to be threatened on-site (Table 5). Another six felt the birds were not threatened, while nine others were not sure. When asked how to improve the site for roosting shorebirds, respondents suggested radio and morning show educational programming, enforcement, education/awareness campaigns, dog-free areas, and interpretive presentations at the local Parks Canada Historic Site. Of the 24, a total of 10 users expressed interest in learning more about the project and provided contact details, and of those, one was interested in helping find solutions (Table 5). In 2017, we sent the results of the first year's audits to those who had provided their emails and asked if they would be interested in helping us to conduct audits, distribute handouts, or talk to their fellow beach users. We invited them to upcoming presentations of Space to Roost at a local university, naturalist's society, and community association, and also asked for their comments and suggestions to improve the project. Three users responded that they thought setting aside one beach was a good idea, that the signage worked well, and provided ideas as to which local groups to join and where to put handouts in town, and which newspapers to target for advertisements.

In 2018, during the second year of testing the Shorebird Resting Beach strategy, we conducted an abbreviated survey with 28 beach users to determine whether the proportion of people visiting who knew the importance of the site to shorebirds had increased, and if they had seen our signs and handouts. All but two of the interviewees had noticed shorebirds in the area, but only 18 (64%) knew the importance of the site to shorebirds (down from 88% in 2017) (Table 5).

However, eight of the 18 who knew the importance stated that they had learned from our signs, handouts, or talking to our researchers. We did not ask if people had done anything differently this year than years previous, as it did not elicit useful responses in 2017. Instead, we asked

whether or not respondents had seen our handouts and/or signage. Twenty-five reported seeing our signs, with two ‘no’ responses, and one declining to answer; only eight had seen our handouts, though nine agreed to take a copy. This might mean we need to be more targeted with handout distribution in future years, and give out more on-site. Overall, however, the percentages of participants who indicated that they did know the importance of the spot to migrating shorebirds increased from 47% in the pre-Shorebird Resting Beach survey in 2016 to 88% and 64% in the post-Shorebird Resting Beach years of 2017 and 2018, respectively.

## **2.4 Discussion**

In this study we set out to increase knowledge about the roosting requirements of migratory shorebirds, and to reduce disturbance to these shorebirds by asking users to avoid one beach on a voluntary basis during high tide in August of 2017 and 2018. Through in-person surveys with all user groups on site, an online survey of anglers, and baseline audits and mapping that showed more shorebird use and less human-caused disturbance on the West Beach than the other beaches in 2016, it was chosen as the ‘Resting Beach’. In 2017 and 2018 we posted signage and distributed handouts at the site, asking users to voluntarily leave this beach for roosting shorebirds. A researcher was present for 10 high tides in 2016, 15 in 2017 and 12 in 2018, roughly equally distributed across mornings, afternoons and evenings, to monitor and catalogue behaviour, conduct formal surveys and talk informally to beach users about the project.

There were challenges in implementing the strategy, including human presence affecting the birds’ ability to find safe roosting space on all three beaches, and users continuing to use the Resting Beach.

The following subsections will discuss how the Shorebird Resting Beach strategy was successful, how successes were assessed, challenges and shortcomings faced, insights into how effective the signage was, increases in shorebird knowledge among site users, opportunities for further research, and recommendations for future research design.

#### **2.4.1 Assessment of the Shorebird Resting Beach strategy**

Our 2016/2017 online and verbal surveys showed that the majority of people who responded were supportive of setting aside one beach for shorebirds. This is important because passing laws concerning bird conservation and their enforcement is easier with support from local users, as was found in an educational campaign on beach user perceptions of beach-nesting birds (Ormsby & Forsys, 2010). Due to small sample sizes in each of the three years of surveys, it is hard to say whether this was a representative attitude. Additionally, due to the fact that these users chose to do the survey voluntarily means that they self-selected and so our results are prejudiced by self-selection bias, which results from a study being composed entirely of voluntary subjects (Hernán, Hernández-Díaz & Robins, 2004, p. 618). Self-selection means that users responded for intrinsic reasons; they already cared about shorebirds, research, conservation, etc., and so therefore are not representative of the average beach user. Indeed, although we did not keep track of how many times a user refused to participate in the survey, some did refuse and continued to refuse regardless of the year or researcher. If a user refused to be questioned, it is impossible to say whether they just wanted to be left alone to enjoy the beach, or if they were fundamentally against some part of our research objectives.

Outreach efforts, handout distribution and signage had a positive effect on shorebird knowledge among beach users at these sites, as the number of people who answered ‘yes’ to the question “Did you know the importance of the spot to migrating shorebirds?” increased from 47% in 2016

to 88% in 2017 and 64% in 2018. The decrease in knowledge from 2017 to 2018 was discouraging, though it is still higher than in 2016, which suggests our educational campaign had some measure of success. There are of course many factors that could account for these numbers, as we could have randomly chosen users with more or less knowledge of migratory shorebirds from one year to the next. There was no intentional bias in who was approached to complete the survey, but those more supportive of conservation may have been more inclined to participate, as addressed above. There were people who self-identified as having been surveyed by one of our researchers in a previous year, which, if they remembered the information, would have led to a higher percentage of affirmative responses in 2017 and 2018 than in 2016.

Based on the decrease in hourly rates of shorebird disturbances from 2016 to 2017 and from 2016 to 2018 on the Shorebird Resting Beach (Figure 5, Table 3), and the lower hourly rates of human caused disturbance on the Resting Beach (West) than on Middle and East Beaches, it appears that the strategy is moderately effective in reducing human caused disturbance, but it did have its challenges. For instance, although there were no disturbances on the Resting Beach by anglers in 2017, the 2018 season saw three anglers causing five disturbances. It is unclear what changed, but it is possible that as the other beaches filled up it became too crowded for them on the other beaches, or perhaps they were willing to play along for one year but were worried that they would lose more ground as time went on. Another explanation of the behaviour of those who persisted in using the Resting Beach might be 'reactance', described as "the desire to engage in the opposite behaviour to that being advocated as a form of protest" by Sussman & Gifford (2012, p. 597 citing Brehm, 1966). Messaging that makes users feel undervalued or angry are more likely to cause reactance (Rofes, 2002), as are messages perceived as attempting to change one's moral norms (Pavey, Sparks & Churchill, 2018). This resistant behaviour by a

subset of the anglers has also been described as the “boomerang effect,” whereby messaging created with one purpose results in the opposite behaviour, as in anti-smoking ads that result in more people choosing to smoke (Hart & Nisbett, 2012). In the case of the anglers, this pushback may be an extension of a protest we received early on from two of the Facebook survey respondents, who wished to continue fishing on all three of The Guzzle beaches. The Space to Roost program and similar conservation programs should avoid proscriptive (do not do this) messaging, often seen as being more coercive or absolute than prescriptive (do this) messaging (Pavey et al., 2018). Messaging perceived as being absolute has been shown to result in feelings of resentment and anger (Rofes, 2002), which in turn causes users to react, or ‘boomerang’ in the opposite direction, and can inadvertently lead to more harm to the program’s conservation aims.

Another indicator of the success of the strategy is the reduction in the number of users choosing to go down to the Shorebird Resting Beach from the dyke above, dropping from just over half of all users before the conservation strategy in 2016, to less than 10% in 2017 and 2% in 2018 (Figure 6). Most stayed on the far side of the sign, and a large group of users would often congregate there to watch the birds on the beach below. These results bode well for the Resting Beach strategy, as it suggests that when given the information and a choice, the majority of users will choose to avoid causing disturbance. From their study of applied behavioural psychology to promote conservation, Clayton, Litchfield & Geller (2013) found that people often copy the behaviour of others, rather than making conscious behavioural changes themselves. Such copied behaviour is evidence of ‘descriptive norms’, described as “what most people do in a particular situation, and they motivate action by informing people of what is generally seen as effective or adaptive behavior” (Reno, Cialdini & Kallgren, 1993, p.104).



Such descriptive norms can go both ways, for example, Clayton, Litchfield & Geller (2013) found that approval by peers was a powerful enforcer of behaviour. This could explain why some users chose to stay on the dyke when a large group of recreational users were present, either copying the behaviour or not wishing to ‘get in trouble’. Following the behaviour of others, rather than making a conscious choice, could also explain the behaviour of users who went down to the Resting Beach when they saw others doing it, despite our signage and researcher presence. On one occasion, two anglers were fishing on the Resting Beach, and a photographer followed them down. When we talked to her upon her return, she said she had not even noticed the signs, just saw others on the beach and decided to follow them. This exemplifies why high levels of compliance are so important; if one person chooses not to comply, others may follow, and greater numbers of shorebirds will be disturbed.

As with many studies of behaviour and ecological processes, it was hard to measure success of interventions as there are so many factors contributing to success/failure. For example, was the Shorebird Resting Beach truly successful in reducing disturbance by human and non-human users, or did it simply displace the disturbance to the other two beaches on site and to other staging areas? Did the higher concentrations of human users on the non-Shorebird Resting Beaches cause more disturbance than if they were spread out over three beaches?

#### **2.4.2 Challenges and shortcomings of the Shorebird Resting Beach strategy**

Total compliance is most likely unattainable, and long histories of use by patrons of the site make compliance even more challenging. Two of the three anglers who chose to use the Shorebird Resting Beach in 2018 bypassed the signage on the dyke and did not wish to speak with our researchers when they exited the beach. They stated simply that they “Had been coming here for 20 years”, the implication being that their long use meant they were entitled to do as

they wished on site. Anecdotal evidence from other beach users confirmed that the third angler who set up on the Resting Beach in 2018 was not persuaded by pressure from other beach users asking him not to go down to the beach, or yelling down to him from the dyke to get off the beach.

Observer effects were also an issue in this study, as there were instances where, while trying to collect the data, birds were disturbed by our researchers. We always remained off of the West and Middle Beaches, because they were easily audited by scope and binocular from the dyke above, but the layout of East Beach was such that it was impossible to get a clear view of the entire beach and its occupants from the dyke above. Researchers would walk down from the dyke and through a marsh to the edge of the beach to conduct the audits, but often times shorebirds would be in the marsh and so would be disturbed as the researchers walked by. We recorded these instances of disturbance, but did not analyze or report on them, because researchers would not be there under normal circumstances. Observer effects would have also been an issue with the human users, as they may have changed their behaviours when they saw the same researcher over and over; especially after completing the verbal survey. After which time they would know what we were expecting of them, and so may have behaved differently only when we were present. Indeed, we did hear reports from other users that anglers and others were going down to the Shorebird Resting Beach when we were not present, and that some were stalking the birds for photographs on the non-Resting Beaches. Due to funding constraints we were not able to be present every day in August. A full-time onsite interpreter, as is the model at Johnson's Mills Shorebird Interpretative Centre in New Brunswick, Canada, might be a good solution to this problem at The Guzzle. In a study of wildlife disturbance at a wildlife refuge, Klein (1993) found that recreational users who talked to on-site interpreters disturbed wildlife

less often than users who did not speak to interpreters. However, this did not include those that were angling, for whom Klein found interpreter interventions made no difference. This is another possible explanation of the behaviour of the anglers that chose to use the Resting Beach in 2018.

### **2.4.3 Insights about signage and handouts**

Overall, the signage was well received by the majority of on-site beach users, and proved relatively effective, especially for walkers, but it may be prudent to change the look of the signs periodically and continue to only install them from mid-July to mid-September, to increase the likelihood that people will continue to notice them. The signage employed in this study was written using prescriptive norms that encouraged certain types of behaviours, rather than proscriptively, that discouraged the opposite behaviour. This approach was employed to make users receptive to the idea of voluntarily leaving the Resting Beach for shorebirds. When designing the messaging of a conservation study, it is important to explicitly state the behaviours you want your subjects to follow, rather than those you wish to suppress, so that you do not inadvertently advertise the ‘bad’ behaviour as the norm (Stern, 2018). Negatively worded signs were also found to be less effective than positive ones in a case study by Aronson & O’Leary (1982), where a sign asking washroom users to reduce their water usage was vandalized and water usage increased after the sign was installed. None of our signs were vandalized or damaged in any year of the study, which surprised the NSDLF, as their on-site signage throughout the province is routinely vandalized. In a study of the effectiveness of beach signage in the conservation of Hooded Plovers (*Thinornis rubricollis*), respondents “regarded colourful images, clear definitions of the issue and appropriate behaviour most effective, with descriptions of fines and authoritative language least effective” (Rimmer, Weston & Maguire, 2013, p. 79). Reiter & Samuel (1980) found similarly that positively phrased signage asking users to reduce

litter were significantly more effective than negative because the negative messaging induced reactance in readers, leading to behaviours opposite to those sought by the researchers.

A study in Australia interviewed users about their beliefs, behaviours and attitudes about feeding wild birds, and then used the information to design and test signage asking users not to feed the birds. They found that users reacted most favourably to signs that established an emotional connection to the birds, and played on people's interest in their welfare (Ballantyne & Hughes, 2006). In their studies of beach user signage preferences, Rimmer et al. (2013) and Ballantyne & Hughes (2006) found that users liked signs that allowed them to draw a personal connection to the birds and understand how their behaviour affected them. Méard, Bertone & Flavier (2008) also found that signs that include a behavioural request, with an explanation as to why the request is being sought, helps the target audience to internalize the message and change their behaviour. Although we put images of the birds on our handouts, perhaps it would be beneficial to also add them to the signs, or to make a Semipalmated Sandpiper caricature that speaks directly to the user, as we did on the front page of our handout (Appendix C). In the Ballantyne & Hughes (2006) study, users also appreciated information about alternate dog-walking or recreational sites, which would be a useful addition to our signage. This advice played out successfully in our case as well, and many users commented favourably about the inclusion of the high tide chart on the back page of our handout (Appendix D5).

It may be prudent to continuously update the signage with new information, imagery, or even alter the shape of the signs or add eye-catching adornments to keep people looking at them and reading the messaging. Otherwise, the decreasing efficacy in 2018, the second year of our study, suggests that beach users may begin to 'filter them out'. It should be noted that there are several existing sets of signage about birds near the parking area that have been in place for many years

and have little demonstrated impact on behaviour, likely having become part of the background of the site (Appendix D6).

Signage effectiveness varied among user groups. The reduction in disturbance by walkers in 2017 was most likely due to the fact that many of the walkers we audited at The Guzzle in 2016 were tourists who arrived, saw the beach and decided to walk there as a spur of the moment decision. For such users, signage asking them to avoid the beach was enough to dissuade them because their decision to walk there was opportunistic and easily replaceable by an alternate path, or they could choose to substitute the walk for bird watching or some other on-site pastime. Their decision not to walk on the beach could also be due to the fact that because they were from away and did not see themselves as experts of the site or the birds; they accepted and complied with the information presented in the signs and by the researchers. This possibility is supported by Manning (2003) who found that information/education programs aimed at visitors who are more knowledgeable/experienced are less effective than those aimed at visitors with less experience or knowledge. Knowledgeable visitors feel they already know the information, and so are less open to it. Walker disturbance incidents were so greatly reduced between years because walkers were more open to the new information presented in the signs. In addition, unlike anglers who have limited locations from which to fish, and birders and photographers, who came specifically for the birds, walkers may more readily choose alternative locations.

#### **2.4.4 Opportunities for further work**

In hindsight, there are limitations to our audit design that require caution be used in interpreting the results. Opportunities for further research include a redesign of the methodology that includes distinguishing between people on the dyke vs the beach, counting loss of habitat by human presence as disturbance, piloting the strategy on a more densely populated beach, examining the

energetic costs of disturbance during foraging and repeated disturbance on individual birds, and introducing buffer zones to decrease disturbance.

Although we found an apparent relationship between the implementation of Shorebird Resting Beaches and reduced numbers of shorebirds disturbed by recreational users, it would be prudent to test the strategy's effectiveness in other locations. Beach users on our four sites in 2016 (Evangeline Beach, The Guzzle, Avonport Beach and Blue Beach), suggested we could include several other nearby beaches that are popular with shorebirds, striped bass anglers and other recreational users. The Nature Conservancy of Canada is planning an expansion of the Bay of Fundy WHSRN sites to include Cobequid Bay and Cumberland Basin (Figure 12), and our conservation 'template', with the refinements mentioned earlier, could be used to foster behaviours that reduce disturbance to shorebirds at these sites. A pilot study in a densely populated area would be a logical next step in testing this method, as our study site is relatively less populated and was chosen by local site users because it is less intensely used and/or valued in relation to other sites (i.e. West Beach of the three Guzzle beaches). A more popular area where space is at a premium would be a good test of whether people are interested and able to share their beach space with shorebirds. There has been interest expressed in piloting the program in British Columbia, Georgia, Maine, New Jersey, New Brunswick and Newfoundland, as well as in the wider Western Hemisphere Shorebird Reserve Network. The signage, handouts and surveys have already been adapted for similar work in Maine, Nova Scotia, New Brunswick, and Newfoundland.

Future studies should account for the disturbance caused when human presence prevents shorebirds from landing. In our study, there were many instances of anglers and other users being stationed on the beach when the birds arrived, with the result of the birds having to fly

away to find an alternate resting space. We only counted disturbances where birds were present on the beach and were disturbed by humans, but perhaps human presence upon attempted arrival could be categorized as a disturbance as well. The omission of these data in our study resulted in counter-intuitive results, whereby large numbers of users were counted on a particular beach, but no birds were disturbed during those periods. This is not because the users were changing their behaviour to accommodate the birds, but because the birds were not landing because of human presence. Although we did not officially count this as disturbance, it was obvious through observation of the human users and birds that the loss of roosting time was considerable across all three beaches and is a concern that should be addressed in future studies. It would be hard to quantify the energetic loss of this kind of disturbance, as it would be impossible to know if the birds spent the entire period flying (which would be very energetically taxing), or if they found an alternate roosting location a short distance away (less taxing). Neima (2016) used stable isotope analysis and radio-telemetry to assess diet and track movement of Semipalmated Sandpipers in the Bay of Fundy, and her supervisor, Diana Hamilton at Mount Allison University, would be a good partner for further research into the energetic costs of disturbance. It would also be interesting to know the full energetic cost of human disturbance to birds in this area by also monitoring disturbance during foraging. One study found that as the density of human users increased, Semipalmated Sandpipers foraged less (Yasué, 2005). The study also accounted for flock size on hourly rates of disturbance, finding that larger flocks are less likely to be disturbed, as the risk is distributed among the flock. We did not account for flock size on hourly rate of disturbance in our study, but it would be an interesting variable to control for in future studies.

This study did not examine the energetic or stress-related costs of being flushed multiple times, but it is no doubt taxing to the individual, and would be an interesting avenue of future study. Photographers in particular were observed following groups of birds until they flushed a short distance away, then following them again, continuing this until the birds finally flushed and did not return. Anglers and walkers were also observed flushing the birds repeatedly but less intentionally as they moved along the beaches; photographers are often specifically interested in the aesthetics of the flushing birds (see Chapter 3).

Future work should also explore reasonable buffer distances that can be recommended on signage, along with an easily visualized reference of suitable distances (e.g. Olympic swimming pools, which are 50m long), so that people can visualize how far away they need to be. Previous studies have made recommendations for implementing 50-meter buffer zones between shorebirds and recreational users (Murchison, Zharikov & Nol 2016; Livezey, Fernandez-Juricic & Blumstein, 2016; Marcum, 2005; Snow, 2001). The Shorebird Resting Beach at The Guzzle was only 42 meters wide at two hours before high tide, and could be reduced to zero depending on the height of the tide, making a 50-metre buffer impossible on the beach itself, but possible on-site in general. Although this research did not measure at what distance a walk/flight response was elicited from the shorebirds, a rule of thumb distance would be useful to employ on signage and as a guideline for beach users, particularly photographers and birders, as their aim is to get as close to the birds as possible.

Another factor outside of our scope was whether shorebirds were disturbed more often by fast moving users. This has been tested in several other studies, with consensus being that birds are disturbed at a greater rate by fast moving sources of disturbance, such as joggers, running dogs,



fast moving boats, etc. (Murchison et al., 2016; Suffolk Coast & Heaths, 2012; Baudains & Lloyd, 2007; Blumstein, 2003).

Further research into what we classified as ‘unknown sources of disturbance’ would be prudent, including breaking this category down further, perhaps showing “Source of disturbance missed by researcher,” “Non-specific human disturbance,” “Non-specific non-human disturbance”, and “Human disturbance from outside/adjacent the study site” (e.g. the farm vehicle noise). It would also be interesting to understand what causes a flock to flush multiple times in a row. A couple of possibilities include that: the location did not afford the birds a 360-degree view of their surroundings, which made them nervous; as the tide went out, the birds became restless to return to their feeding grounds; or, a few nervous birds continuously signaled a false sense of danger to the flock and caused them to flush. Another possibility could be the width of the available beaches: Murchison et al. (2016) found that shorebirds spent longer periods of time at wider beaches, and as mentioned above, our Shorebird Resting Beach was only 42 meters wide two hours before high tide, and could be reduced to zero at peak high tide due to the dyke wall behind it, making it a sub-optimal choice of resting beach, in hindsight. Our work here focused on the human element, but these other dimensions are important to the overall issue.

The results of this study have shown that we had some modest success with our collaborative conservation aims but were less effective than anticipated and could have been stronger overall. In the end, involving one set of local users in a one-time only engagement within a collaborative conservation framework is insufficient (i.e., the one-time Facebook survey of anglers). We found accessing on-site user groups challenging, and even in the case of users we did reengage with, results were mixed. Bäckstrand et al. (2010) found that collaborative engagement outreach is mainly geared toward well-known stakeholder groups that are highly organized, like registered

charities (e.g. the Blomidon Naturalists Society), academic institutions (e.g. Dalhousie University) and governments (e.g. NSDLF, Environment and Climate Change Canada). They found that other groups with a looser structure (e.g. a photography group or a couple of anglers that always meet at the same beach at the same time), are less likely to be noticed and so are less likely to be recruited to help make decisions. In our study it would be ideal to either have a yearly Facebook survey or focus group, or to invite ambassadors from each of the main user groups to attend meetings and become partners in the Minas Basin shorebird conservation partners “Space to Roost” project planning group. There, along with provincial and NGO managers, they could consider the results of the project together, derive solutions, and foster self-peer monitoring and compliance.

#### **2.4.5 Recommendations for future research design**

The limitation of not differentiating between the beach and the dyke in each section was that it made it hard when analyzing the data to know whether people were staying on the dyke as we asked them to do in our intervention, or if they were going down onto the beach (where the birds were and where disturbance was likely). We did manage to tease these data out of our site audit maps (Appendix E3) for West Beach, but it was too cumbersome to do for all three beaches, and the approach of trying to pull these data from the maps after the fact was not as accurate as it could have been if our audit sheet had separate delineations of ‘West Beach dyke’ and ‘West Beach beach’.

A limitation of our study design was counting every incidence of disturbance throughout the audit period, but only counting the number of birds present every 30-minutes. This was practical but made it hard to analyze the data and understand what proportion of total birds present were disturbed. For example, if there were no birds present at a 1:00 pm spot check, then 2,000 landed

at 1:05 pm, then flushed at 1:25 pm, the 2,000 would not be counted in the 1:00 pm nor the 1:30 pm spot check, but they would be counted as having been disturbed, which made our data look like 2,000 birds were disturbed when there were zero birds present. A more accurate ratio of birds present to birds disturbed would have also helped us explain instances when no birds were disturbed simply because none were present. The 30-minute spot check approach also made it difficult to know the locations of users in real-time, as their locations were only added every 30-minutes, and so did not illustrate if for example, a user was on the beach between spot checks, unless they caused a disturbance in that time.

## **2.5 Conclusions**

Overall, the implementation of dedicated Shorebird Resting Beaches shows promise as an effective tool when managers are confronted with conflicts between the needs of shorebirds and the desires of recreational users. We recommend Resting Beaches in tandem with ‘boots on the ground,’ whether that be conservation officers, interpreters, researchers or volunteers who can explain the needs of the shorebirds and why it is so important to give them ‘Space to Roost’. This is because trying to increase visitor knowledge using only signage and handouts has been found to not be as effective as more interactive methods (Manning, 2003). However, we found that even the combination of signage, researcher presence, education and outreach was not always enough to keep all users off the Resting Beach. Users who felt a sense of ownership of the site were especially problematic, often resisting by saying that they had “been coming here for decades,” or their family has been using the beach for generations. Once a user stationed themselves on the Resting Beach, others inevitably followed, being emboldened or assuming that such usage was allowed. In most cases when anglers or others set up on the Resting Beach, the shorebirds would fly near the beach but would not land, so the beach would be lost to them for

the duration of the users' stay. This study did not consider the disturbance caused by users who were present when the shorebirds tried to land, which is a limitation and explains some of the counter-intuitive results on all three of the beaches, where, for example, anglers were present but there was no recorded disturbance. The loss of roosting time in this way is a concern that should be addressed in future studies. It became clear in year two that if even one person went down to the beach, others would follow. Once users installed themselves on the beach during high tide, the damage was done, as the birds were forced to find alternate roosting habitat, or spend high tide flying around the bay, wasting precious resources. This highlights the limitation in our audit methodology of using only the 'number' of disturbance without considering duration of disturbance and/or the effect that shorebird avoidance plays.

This project employed collaborative conservation as one of its theoretical frameworks, which aims to involve stakeholders in an effort to "involve the public in a process of collective understanding and learning that will contribute to innovative solutions that serve multiple interests" (Bardati & Bourgeois, 2008 p.740 citing Randolph, 2004). Yet, during our online survey of striped bass anglers, we had a few users state that they were entitled to fish wherever they wanted, and the police would need to intervene to remove them. The anglers who chose to use the Shorebird Resting Beach in 2018, despite signage and explanations by researchers of shorebird requirements, most likely had this mentality. For a subsection of the population, voluntary Shorebird Resting Beaches in the form outlined in this paper may always prove ineffective. Compliance will continue to be an issue without personnel on site to support the program, especially as the signage becomes commonplace for the users and so more easily ignored. Continuous funding for researcher/interpreter presence is paramount to ensuring compliance.

The substantial drop in the number of users choosing to go down to the beach from the dyke above from 2016 to 2017 and again in 2018 was very heartening. The decrease in users going down to the beach from 2016 to 2017/2018 was probably due in large part to a shift away from anglers using that beach. Anglers must go onto the beach itself to fish (which they did in 2016), whereas tourists, birders, photographers, walkers, and others can enjoy their activities from the dyke. This change in usage does, however, support claims in the literature that signage and researcher explanations of shorebird roosting requirements are effective deterrents for the majority of users.

The usefulness of signage, handouts and researcher presence was further supported by the increase in user knowledge about shorebirds and their migratory requirements reported from 2016 to 2017 and from 2016 to 2018. Although self-selection bias played a part in who agreed to complete the verbal survey and so was not necessarily a representative sample of the population, those who responded were overwhelmingly positive about setting aside a portion of The Guzzle site for shorebird use during high tide periods in August.

With interest in this conservation strategy from many other groups both nationally and internationally, it seems likely that the program will be tested in other areas, which is an important step in improving and assessing its efficacy. Future work could focus on disturbance duration and avoidance of humans by shorebirds, and incorporate the testing of buffer distances and the differences of flock size and speed of approach on disturbance rates.

This research contributes to collaborative conservation and human dimensions of wildlife management by providing evidence to support the view of the importance of developing conservation strategies in collaboration with those seen as causing conservation challenges with ongoing 'consent' processes throughout the study. Even though we had disturbance on the

Shorebird Resting Beach in 2017 and 2018, these events were caused by a minority of users. Therefore, it is clear that the vast majority of the people on site during the pilot respected the Shorebird Resting Beach. Although we spoke to hundreds of users on site and completed surveys with many, engaging users off site, in particular anglers, was a persistent challenge that we were not able to overcome. Overall, we had mixed success in trying to deal with human-shorebird conflicts by empowering users to be a part of the solution.

## **CHAPTER 3: FOCUSING ON PHOTOGRAPHERS: AVOIDING SHOREBIRD DISTURBANCE IN THE QUEST FOR THE PERFECT PHOTOGRAPH**

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Target journal: *Society and Natural Resources*

Note: I am targeting a practitioner knowledge style paper in the above journal, which is shorter than usual journal articles.

### **3.1 Introduction**

Wildlife photographers can have a deleterious impact on the environment they seek to capture.

Unlike other recreational user groups, photographers want to get as close to wildlife as possible,

and as a result, have been found to be one of the most harmful sources of disturbance (Klein,

1993). Negative effects to birds by bird watchers and photographers were found in 19 of 27

studies reviewed by Boyle & Samson, (1985), and photographers were found to be the top source

of disturbance to birds, above nature watchers, anglers, shell collectors and boaters, in a study in

Florida (Klein, 1993). The same study found that although nature watchers stopped their cars as

often as photographers, they were less likely to get out and approach wildlife. Seeking out rare

birds to add to lists, approaching closely for identification, and seeking birds out at important

feeding or resting sites all have detrimental effects on the birds' ability to survive and thrive

(Knight & Cole, 1995). Disturbance at sensitive times is especially harmful to migratory birds

within their staging areas, where they have limited time to put on weight to complete their

migration and cannot do so if they are constantly being forced to fly away from sources of

disturbance, such as recreational beach users (Murchison et al., 2016).

The Bay of Fundy is part of the Gulf of Maine, located between Nova Scotia and New Brunswick in Canada, and Maine in the US. Semipalmated Sandpipers and other fall migrants use the Bay of Fundy as a stopover site during their migration from their Arctic breeding grounds to their wintering grounds in South America (Brown et al., 2017; Neima, 2016; Hicklin & Smith, 1984). As a result, the Southern Bight of the Minas Basin, on the Nova Scotia side of the Bay of Fundy, has been classified as an Important Bird Area (IBA), a Western Hemisphere Shorebird Reserve Network Site (WHSRN), a National Wildlife Area, and a Ramsar Wetland of International Importance (IBA Canada, n.d., para. 2) (Figure 7).



**Figure 7:** The orange outline denotes the Southern Bight of the Minas Basin, Bay of Fundy, Nova Scotia, Canada, which has been classified as an Important Bird Area (IBA), a Western Hemisphere Shorebird Reserve Network Site (WHSRN), a National Wildlife Area, and a Ramsar Wetland of International Importance. Source: [ibacanada.org/mapviewer.jsp?siteID=NS020](http://ibacanada.org/mapviewer.jsp?siteID=NS020)



*The State of Canada's Birds 2019* reported reductions of 40% of all of Canada's shorebird species since the 1970's (NABCI, 2019). Migratory birds with long ranges, like the Semipalmated Sandpiper, show even more dramatic declines, having decreased by 52% of their 1970 populations worldwide (NABCI, 2019). The report cites many reasons for these declines, including climate change, unsustainable shorebird harvesting along their migratory route, and degradation of habitat and coastal developments. In addition to all of these factors, disturbance is another threat to shorebirds across their migratory range, as it impacts the birds' ability to acquire sufficient fat stores in the Bay of Fundy and other staging areas to complete their 4,000 km over-ocean flight to South America (Gratto-Trevor et al., 2012). At high tide, when their feeding grounds are covered, the birds rest, but this is also the most popular time for people to swim, fish, take pictures of the birds or birdwatch. This intersection of demand for limited space results in shorebird disturbance, and when shorebirds are disturbed, they walk or fly away from the disturbance (flush), which burns critical fat stores.

This paper shares the development and testing of a Shorebird Resting Beach strategy, the main instrument of Space to Roost, a program led by Birds Canada to reduce disturbance by beach users to migratory shorebirds at high tide roosting sites. Space to Roost was designed based on engagement with a local naturalists' group and recreational beach users, as well as a survey of striped bass anglers who were the main user group at a site called The Guzzle in Nova Scotia. The Shorebird Resting Beach strategy included signage, direct engagement by conservation group members, and one of three beaches on-site being set aside exclusively for shorebird use during high tide in August. Although it was clear from the onset that anglers would be a source of shorebird disturbance and it might be challenging to encourage them to avoid disturbing shorebirds, a surprise was that shorebird photographers, who were assumed to be naturally

aligned with shorebird protection and conservation, were found to have the second highest rates of disturbance, despite being the third most numerous user group on-site.

We seek to understand the lack of efficacy of the Shorebird Resting Beach strategy for some shorebird photographers, despite its demonstrated efficacy with other types of recreational users. We conclude with recommendations for engaging this photographer sub-group in conservation activities, including potential ways they could be convinced to put the needs of the birds ahead of their desire to approach and photograph them.

## **3.2 Methods**

### **3.2.1 Study area, audits, surveys, and implementation of the Shorebird Resting Beach**

The Guzzle, Kings County, Nova Scotia, Canada is located within the Southern Bight of the Minas Basin in the Bay of Fundy (Figure 7). It is one of four sites identified by provincial and federal biologists and the local Blomidon Naturalists Society in 2015 as a site where shorebirds were being disturbed by recreational users during high tide resting periods. The Guzzle is composed of three beaches abutted by dykes to hold back the tides from adjacent farmland (Figure 2), which as part of the Bay of Fundy, boasts some of the highest tides in the world. Tens of thousands of shorebirds stop in the Bay of Fundy on their way from the Arctic to South America from mid-July to mid-September (Hicklin & Smith, 1984; Hicklin 1987; Hamilton et al., 2006; Gratto-Trevor et al., 2017). At low tide they feed, and at high tide their feeding grounds are completely covered by water, so the birds roost on the upper edges of the beaches, and on the armour rock bordering the dyke walls. This roosting time makes the birds susceptible to disturbance by recreational beach users. In order to reduce the amount of human-caused disturbance to shorebirds, we conducted audits of shorebird and human use, completed verbal surveys with recreational users and conducted an online survey of striped bass anglers, who were

the main user group at this site. These methods are described briefly below, but a fuller treatment can be found in Chapter 2. Based on the feedback we received and the results of the first year audits, which showed less use by anglers than on the other beaches, we chose one of three beaches to set aside as a Shorebird Resting Beach, asking users to avoid this beach on a voluntary basis during high tide in August 2017 and 2018.

Pre-and post-conservation implementation site audits of bird disturbance were adapted from Burger & Niles (2013), Suffolk Coast & Heaths (2012) and Peters & Otis (2007). In August 2016, to acquire a baseline, four sites in the Minas Basin (Evangeline Beach, The Guzzle, Avonport Beach and Blue Beach), were audited for a maximum of four hours from two hours before and after high tide. Every 30-minutes, spot checks were performed of shorebird location and flock size, number, location and type of human user (angler, birder, boater (including motorized and paddle), sunbather, swimmer, vehicle (including bicycles and vehicle sounds), walker and walker with on or off-leash dog). In the 2016 audit, 'bird photographers' was not a separate category of user, but after several incidents of disturbance involving birders taking photos, we added the category in 2017/2018. Incidents of shorebird disturbance, including location, cause, number of disturbers and number of birds disturbed, were noted whenever they occurred throughout the audit. Causes of disturbance included human (tracked separately for each type of user), predatory bird (Peregrine Falcon, Northern Harrier, etc.), non-predatory bird (other shorebirds or gulls flying over would often flush the shorebirds) and unknown (disturbances that had no apparent cause, or were not directly observed by the researchers) (Appendix E). The continued presence of humans at high tide throughout peak migration in August dissuaded shorebirds from landing and utilizing the beaches as roosting sites at high tide, but due to a methodological oversight, this was not counted as disturbance in this study.

The majority of beach users agreed in 2016 that West Beach would be the best location for a Shorebird Resting Beach, so we asked all recreational users to avoid this beach during high tide in August 2017, and again in 2018 (Figure 2). We erected a sign at the entrance to the Guzzle site (Appendix D) with handouts in French and English affixed in a rain-proof container (Appendix C), and installed temporary sandwich board signs on the dykes above either end of the Resting Beach (Appendix D). Handouts were given out by the researcher during audits and were distributed to local businesses to make available to their patrons.

To assess the impact of the conservation pilot in 2017/2018, the site was audited from August 1-31<sup>st</sup>, using the same method as the baseline audits in 2016: 15 times for a total effort of 55 hours in 2017; and, 12 times for a total effort of 42.5 hours in 2018 (Table 1). To get a sense of how successful the Shorebird Resting Beach was in reducing disturbance to shorebirds during high tide roosting periods, we needed to compare disturbance across the three years of the study (2016-2018), as well as the three beach sections: West Beach, which became the Shorebird Resting Beach in 2017 and 2018, Middle Beach and East Beach. To account for the difference in number of hours between years, an hourly rate of disturbance was calculated for each disturber type. These factors were compared between the three years and three beaches.

Verbal *in-situ* surveys were adapted from Burger & Niles (2013) and were first conducted in 2016 (Appendix A), before the conservation intervention, to ascertain why users were choosing to recreate at these four sites, whether they knew the value of the sites to shorebirds, and whether they were interested in getting involved in the project. The short verbal survey was approved by the Dalhousie Research Ethics Board (REB # 2016-3950) and administered on-site, with the researcher paraphrasing the answers as they were given. Similar surveys were used for monitoring purposes in subsequent years. In 2017, the first year of the conservation intervention,

the verbal survey was adapted to include the question “Did you do anything differently in this year than in years past?” in the hopes of eliciting a response about a change in behaviour in regard to the shorebirds as a result of our signage, handouts and/or researcher presence. In 2018, we reduced the verbal questionnaire to three questions: “Have you noticed shorebirds on site,” “Did you know the importance of the site to shorebirds,” and “Have you seen our signs”.

Beyond the quantitative audits and verbal surveys described above, the researchers engaged beach users in conversations about the conservation program, including occasionally making requests for behavioural changes. Responses to those requests were recorded on paper, particularly when conflict arose, which did sometimes occur. To get the word out about Space to Roost, presentations about shorebird migratory requirements were given on site, to local community groups and media.

### **3.2.2 Comparing photographers to anglers**

This paper will focus on shorebird disturbance by photographers, who were an unexpected and persistent challenge in this conservation implementation. For context, we compare them with anglers, the largest and most disruptive user group on-site.

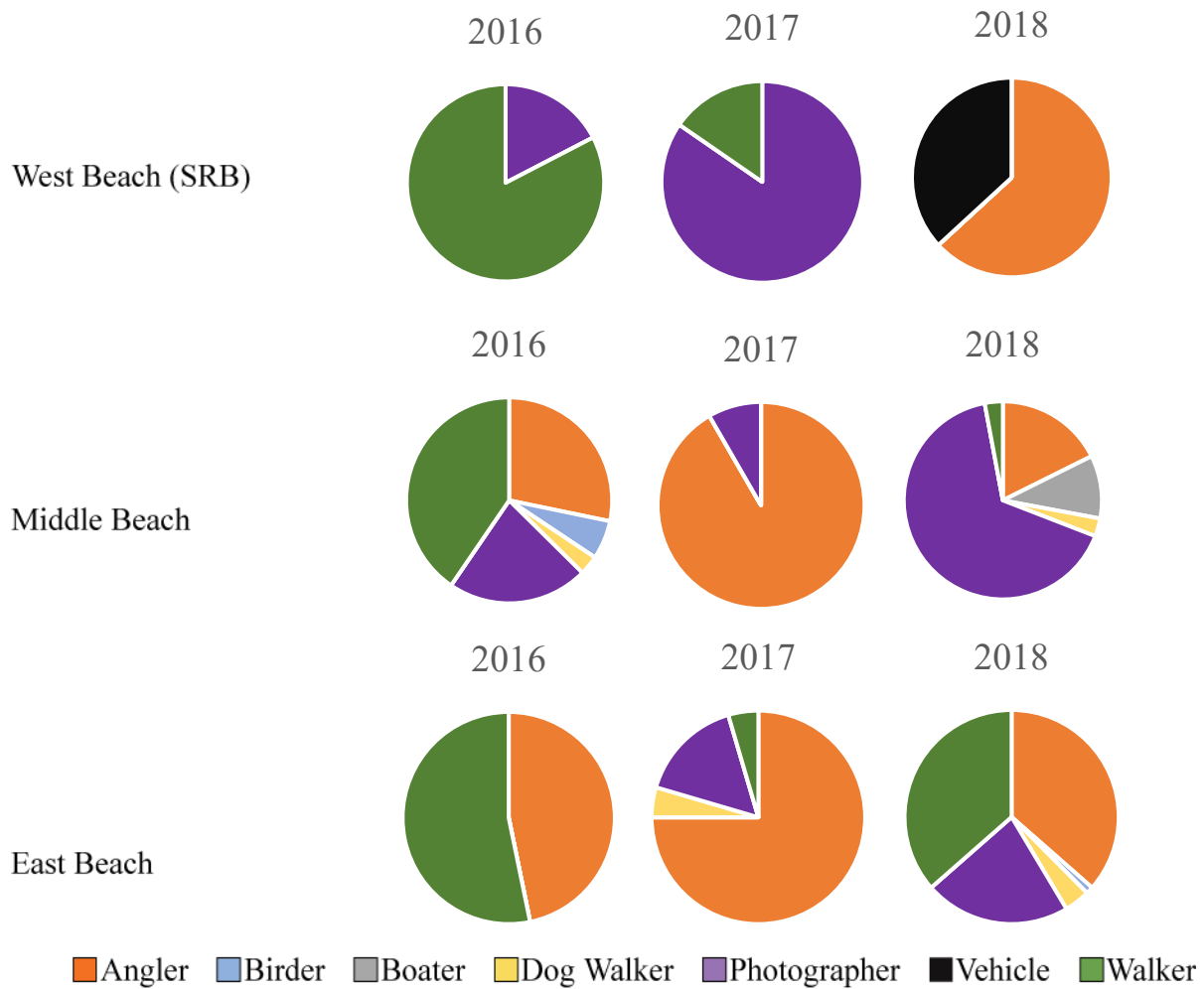
Survey responses of these two user groups were analyzed through descriptive statistics of each question, by user type. Photographers caused the second highest hourly rate of disturbances, despite being the third most numerous group across the three-year study (493 anglers, 405 walkers and 280 photographers) of all user groups at the Guzzle (Figure 8, 9 Table 6). In 2017/2018, there were 334 walkers, 323 anglers and 244 photographers. Survey responses by photographers and anglers were analyzed by collating the responses and categorizing them by response. Comparisons were made between responses from photographers and anglers, with

specific attention given to how photographers and anglers describe the impacts of their own groups, and other groups, on birds.

We compare the number and hourly rates of disturbance, survey responses and observational data between the two groups on both the Shorebird Resting Beach and the non-Resting Beaches, to understand the similarities and differences between the two groups, and to assess the impact photographers had on their shorebird subjects.

### 3.3 Results

Of the human sources of disturbance on West Beach in the two years after identifying it as a Shorebird Resting Beach (2017/2018), anglers had the highest hourly rate of disturbances (0.12 disturbances/audit hour in 2018), followed by photographers (0.11 disturbances/audit hour in 2017) (Figure 8, Chapter 2 Table 3).



**Figure 8:** Distribution of disturbance by beach, year and user type, using hourly rates at The Guzzle, NS Canada.

Across the non-Resting Beaches in 2017/2018, anglers caused the highest rates of disturbance on Middle and East in 2017 and photographers caused the second highest rates. On Middle in 2018,

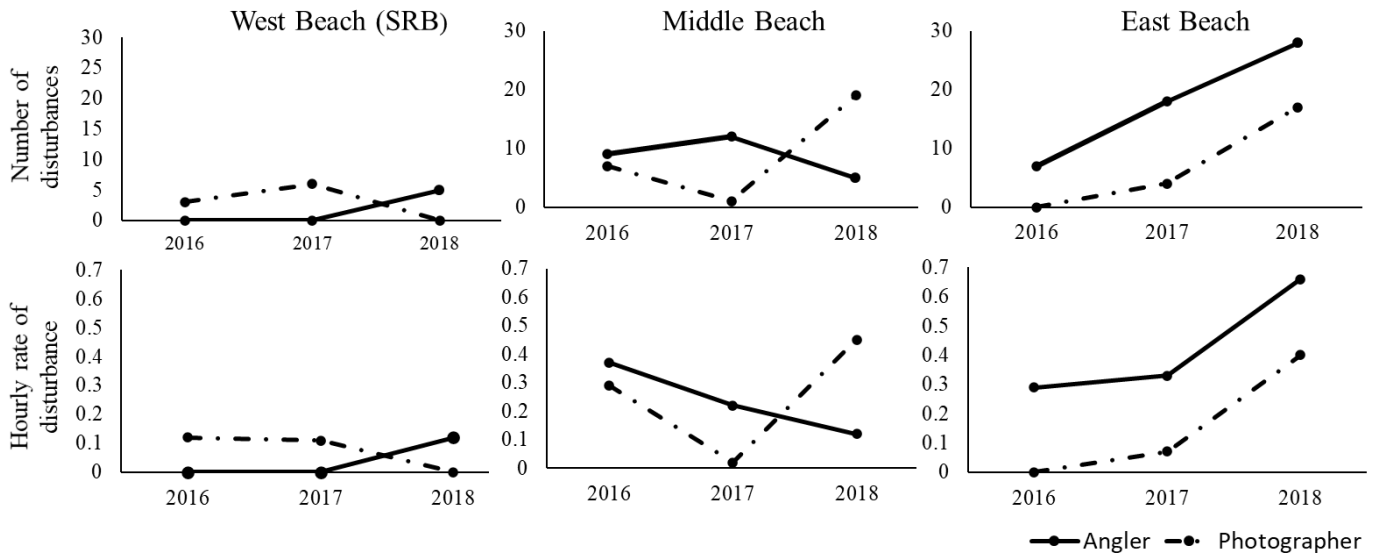
photographers caused the highest rates, followed by anglers. On East in 2018, anglers and walkers were tied for highest rates of disturbance, followed by photographers (Figure 8). These disturbance results are fully described in Chapter 2, but it is clear from Figure 8 that anglers caused the highest share of disturbance overall in 2017-2018 across the three beach sections, followed by photographers.

### **3.3.1 Comparing number and hourly rate of disturbance of photographers and anglers**

Anglers and photographers had very different patterns of disturbance over the baseline and pilot years. Prior to the implementation of the Resting Beach, in 2016, photographers caused three disturbances in 2016, with a rate of 0.12 disturbances/audit hour. Anglers, meanwhile, caused zero disturbances that year. In the first year of the Resting Beach strategy, 2017, one photographer caused six disturbances, with a rate of 0.11 disturbances/audit hour (Figure 8, 9, Table 6). Anglers remained at zero disturbances in 2017. In the second year of the strategy, 2018, photographers caused zero disturbances, but three anglers caused five disturbances, with a rate of 0.12 disturbances/audit hour. Since we unfortunately did not differentiate between users on the beach versus users on the dyke, we cannot speak to differences in numbers or hourly rates of human users. Although we can see from Table 6 that there were 131 photographers and seven anglers present in 2017/2018, we cannot say if they were on the beach not causing disturbance, or on the dyke not causing disturbance. The only thing we can say, is that we ‘caught’ one photographer and three anglers causing disturbance in 2017/2018. This means that individual photographers caused higher rates of disturbance on the Resting Beach than individual anglers did, although this is not a statistically significant result, since we are only talking about one incident in the case of both user types.



The number of disturbances by photographers more than quadrupled from year one of the strategy (2017) to year two (2018) on the non-Resting Beaches (Figure 9, Table 6). The hourly rate on Middle Beach in 2018 was twenty-two times higher than in 2017, and six times higher on East Beach in 2018 than 2017. In comparison, on Middle Beach, the number of disturbances by anglers increased from 2016 to 2017, but the rate decreased. In 2018, both the number and hourly rate decreased. On East Beach, both the number and rate of disturbances increased year after year.



**Figure 9:** Number and hourly rate of shorebirds disturbed by year and beach section, comparing anglers and photographers at The Guzzle, NS Canada.

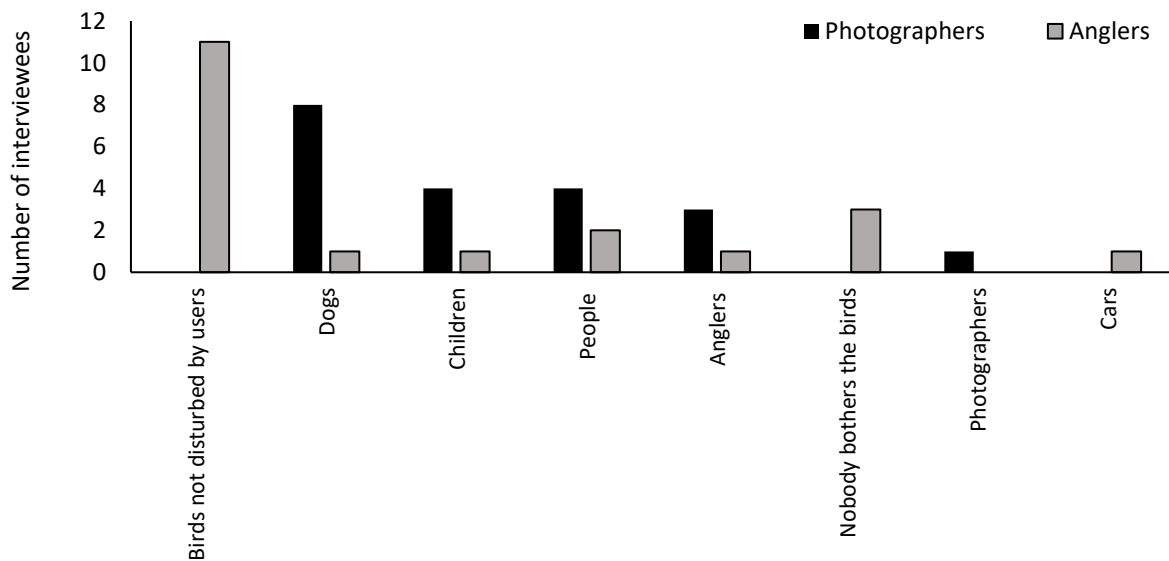
**Table 6:** Comparing photographer and angler-caused disturbance pre-conservation strategy (2016) to post-conservation strategy (2017, 2018) by beach section: (A) Number of photographer and angler-caused disturbance incidents; (B) Hourly rate of photographer and angler-caused disturbance (C) Number of human users on beaches and dykes by section (See Figure 2 for section delineation) (D) Rate of human users (number of users (by user type)) divided by number of spot checks per year at The Guzzle, NS Canada.

		<b>A) Number of shorebird disturbances</b>			<b>B) Hourly rate of disturbance</b>			<b>C) Number of users on beaches and dykes by section</b>			<b>D) Rate of human users on beaches and dykes by section</b>		
		2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
West Beach (SRB)	Angler	0	0	5	0	0	0.12	25	4	3	0.45	0.03	0.03
	Photog	3	6	0	0.12	0.11	0	18	44	87	0.32	0.35	0.91
Middle Beach	Angler	9	12	5	0.37	0.22	0.12	32	29	12	0.57	0.23	0.13
	Photog	7	1	19	0.29	0.02	0.45	18	40	44	0.32	0.32	0.46
East Beach	Angler	7	18	28	0.29	0.33	0.66	111	161	114	1.98	1.29	1.19
	Photog	0	4	17	0	0.07	0.40	0	13	16	0	0.10	0.17

### **3.3.2 Comparing survey responses and observational data of photographers and anglers**

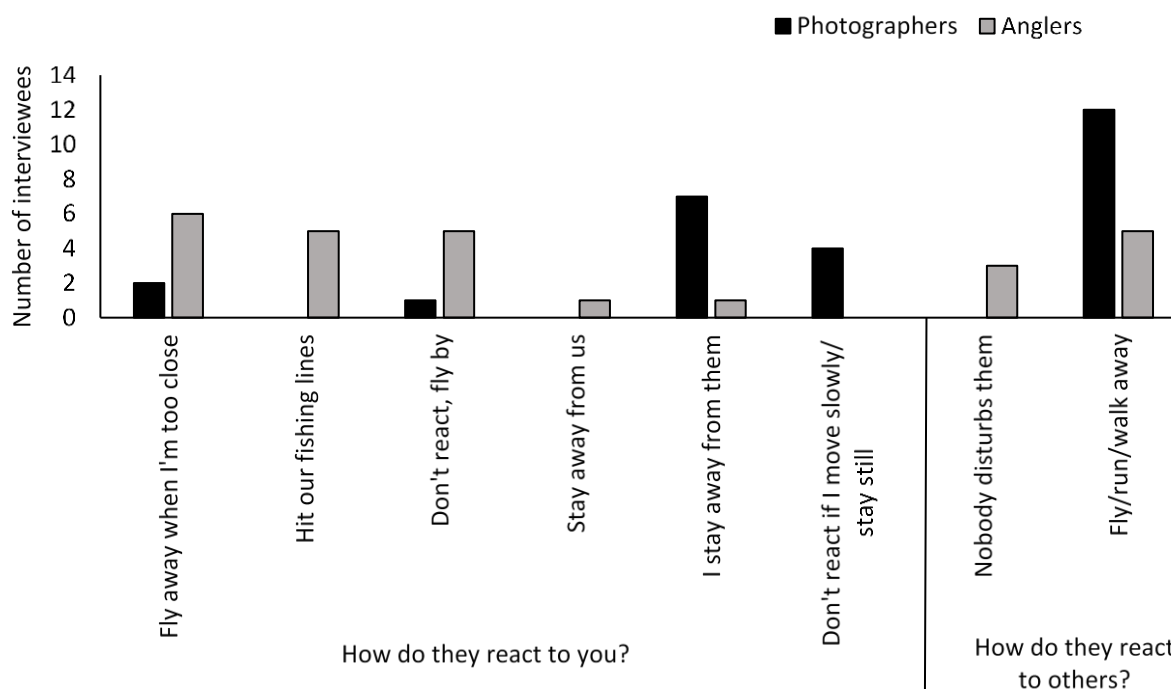
When completing questionnaires with on-site users throughout the three-year study, eighteen interviewees were identified at The Guzzle as bird photographers, through the presence of cameras as well as observed behaviour of photographing the shorebirds. Anglers were the most numerous user type on site, and 30 interviewees were identified as anglers throughout the three-year study, through the presence of fishing gear as well as behaviour of fishing. In the case of all surveys, after giving a synopsis of the importance of the site to migratory shorebirds, the researcher asked, “Did you know the importance of this site to migrating shorebirds?” Of the eighteen photographer respondents, most (n=16) answered ‘yes’. Of the 31 angler respondents, a little more than half (n=18) answered ‘yes’ and the remainder (n=13) said ‘no’. Thirteen photographer interviewees were asked if they thought shorebirds were threatened in the area, and half (n=6) said yes, a third (n=4) said no, and a quarter (n=3) that they did not know. Of nineteen anglers, the majority said ‘no’ (n=10), a little more than a quarter said ‘yes’ (n=5) and the remainder said they did not know (n=4). Anglers have no vested interest in the birds, and so it was not a surprise that they would be less aware as a group of their conservation status or their resting and migratory requirements. Shorebird photographers, however, came to the site for the sole purpose of photographing migratory shorebirds, and knew a great deal about the status, physiology, and migratory requirements of the birds.

In 2016 and 2017 we asked beach users the question “Do you see shorebirds reacting to beach users?” and all photographers answered ‘yes’ (n=13). Several of the photographers gave multiple answers about the causes of disturbance, with two thirds (n=8) identifying dogs, a third (n=4) children, another third (n=4) ‘people’, and a quarter (n=3) responding ‘anglers’. Only one photographer pointed to their own group, stating that photographers disturb the birds (Figure 10). In the case of the nineteen anglers who answered the question “Do you see shorebirds reacting to beach users?” a little over a quarter said ‘yes’ (n=5), ascribing that disturbance to (one each): people and cars, dogs, children running at the birds, “people” generally, and anglers. Of those anglers that said they did not see shorebirds reacting to beach users (n=14), eleven reported that they had never seen shorebirds reacting to beach users, and three said that nobody bothers the birds (people purposefully avoid disturbing them).



**Figure 10:** Response from photographers and anglers as to which (if any) recreational beach user groups cause the most disturbance to shorebirds (n=32).

When asked how the birds react to other users, all twelve of the photographers stated that they fly/run/walk away. Eight of the eighteen anglers chose to answer this question, with just over half saying the birds fly/run/walk away (n=5) and more than a quarter (n=3) stating that people leave the birds alone, and nobody bothers/chases them (Figure 11).



**Figure 11:** Photographer and angler interviewees reporting on how shorebirds react to themselves (left) and to other beach users (right) at The Guzzle, NS Canada.

All fourteen photographers responded when asked how the birds react to them: half (n=7) stated that they stay far away from the birds and do not disturb them; a quarter (n=4) stated that if they move slowly or stay still, the birds move towards them and are not disturbed; two, that the birds

flushed when they got too close, and one, that the birds do not react at all (Figure 11). All eighteen anglers chose to answer the question “How do the shorebirds react to you?” with a third (n=6) saying they fly away, a quarter (n=5) saying the birds hit their fishing line and then either keep flying, or fall into the water and then fly away (this result is obviously unique to the anglers and cannot be compared with photographers). Another quarter of anglers (n=5) said the birds do not react to them, and just fly by or around them. One respondent said the birds do not react because they stay away from the anglers, and one reported the birds do not react because he stays away from them or walks slowly when they are around.

### **3.4 Discussion**

During the course of this study, we set out to understand how shorebirds and recreational beach users were using the Guzzle site, what sources of human-caused disturbance were most prevalent, and how we might engage with beach users to inspire them to change their behaviour for the health and well-being of the birds. We had challenges with anglers, which was expected, but the biggest surprise were the shorebird photographers, who we had assumed would be conservation minded and want to leave shorebirds ‘space to roost’. On the Resting Beach, individual photographers caused higher hourly rates of disturbance than individual anglers did, because one photographer flushed the birds six times, which resulted in a 0.11 hourly rate of disturbance, while three anglers flushed the birds five times, which resulted in a 0.12 hourly rate in 2018. In that way, fewer photographers caused higher rates of disturbance. However, in both cases we are talking about one incident, so we do not have enough data to make any quantitative pronouncements, which makes the formation of conclusions difficult, but there are qualitative methods from which to gain insight.

Verbal surveys were one such qualitative method that provided insight into our conclusions. The surveys were administered throughout the three-year study, and four of the fourteen photographers responding (29%) stated that if they moved slowly toward the birds and/or stayed still, the birds would come closer to them, and were not disturbed by their presence. This was a common comment from anglers as well. Unfortunately, the belief has harmful effects: at some point the recreational user moves, either to adjust position or to leave, and as a result, the birds flush, wasting valuable energy. Another outcome that was observed was other beach users seeing a photographer or angler sitting or standing next to the birds, and deciding to get closer to them as well, and in doing so, flushing them in the process. The influence of the behaviour of others is known as descriptive norms, which are defined as “what most people do in a particular situation, and they motivate action by informing people of what is generally seen as effective or adaptive behavior” (Reno et al. 1993, p.104).

A subset of the photographer group continued to approach and disturb birds on the non-Resting Beaches throughout the three-year study. Although these two beaches were not designated Shorebird Resting Beaches, the first author assumed that users who were more aware of shorebird migratory requirements, like photographers, would also choose to avoid disturbing birds on the non-Resting Beaches, and the vast majority did. In 2016, we only surveyed a small proportion of the photographers on site for their willingness to set aside a Shorebird Resting Beach and did not use a Facebook survey as we did with the anglers, assuming photographers would agree with the approach. For a small subset of the photography group however, this was not the case. Across the non-Resting Beaches, anglers caused the highest hourly rates of disturbance in 2017 but photographers caused the second highest rates. On Middle in 2018, photographers caused the highest rates, followed by anglers. On East in 2018, anglers and

walkers were tied for highest rates of disturbance, followed by photographers (Figure 8). These disturbance results are fully described in Chapter 2, but it is clear from Figure 8 that both anglers and photographers are worthy of more time and attention in future work of this sort and that some assumptions that we made about the cohort were incorrect. Although many photographer members of the Blomidon Naturalists Society (BNS) were included in our collaborative conservation efforts from the onset of the program, non-BNS photographers should arguably have been included to a greater extent.

Wildlife managers need to be aware of the energetic outputs to migratory shorebirds that photographers cause when they flush the birds. These results were echoed by Klein (1993) who found photographers to be one of the most harmful sources of disturbance. This is because bird photographers are often looking to add species to their lists, especially rare birds, and want to get as close as possible to the birds in order to identify them, which causes more disturbance (Knight & Cole, 1995).

There are many competing explanations for why the behaviour of some photographers was not inherently inline with that of our conservation strategy, and why some continued to disturb the birds by approaching them too closely. Possible explanations include: the belief that they know how to approach the birds so as not to flush them; formal and informal competitions for the best shorebird photograph on social media and elsewhere; denial of their own impact on shorebird health; and the belief that while they may disturb the birds, it has a net positive outcome (e.g. educating others about the birds through their photography). The belief by some shorebird photographers that they are not a source of disturbance and/or are not harming the shorebirds may be a result of self-identity bias (also known as self-favoring bias or self-serving judgement), whereby one believes that one's own values and behaviours are superior to others' (Peters,



Daniels, Hodgkinson, & Haslam 2014). Self-identity bias has been observed in studies relating to many aspects of human behaviour, including self-other comparisons of levels of physical activity (Wilcox & King, 2000), reasons for eating certain things (Sproesser, Klusmann, Schupp & Renner, 2017), and job performance (Rosenberg, 1979), to name but a few. Photographers may also believe their group is more enlightened in relation to shorebirds than other recreational beach users such as anglers, because photographers are there for the birds and know more about them, and so believe they cannot possibly be causing harm. This is known as a group self-serving judgement (Roose & Olson, 2007), or ingroup-outgroup bias, favoring members of one's group over others (Brewer, 1979; Brewer & Kramer, 1985; Brown, 1986).

The negative reaction by some photographers to explanations by our researchers that their behaviour harms the birds may be explained by findings from a study by Roose & Olson (2007). These authors found that, when threatened, people were more likely to respond with a self-serving judgement, as was the case with some members of the photographer group in our study who reacted by blaming other groups (e.g., dog-walkers, anglers, etc.). Therefore, further attempts by the research team to curb the photographers' behaviour, through signage, handouts or verbal interventions, would result in a stronger self-serving judgement that they were in fact not harming the birds. This polarized response may also explain why, after speaking to a few of the photographers in 2017, we saw the same photographers exhibiting the same harmful behaviour in 2018; our explanations that their behaviour was harmful to the birds was damaging to their self-judgement, so they did not heed them, and indeed reacted angrily in some cases when asked to change their behaviour and avoid approaching the birds.

Another reason for the negative reaction from a subset of the photographer group might be the proscriptive (don't do this) messaging used by our researchers when asking them not to disturb

the birds, as opposed to using the prescriptive (do this) norms that we used in our signage. In a study of alcohol consumption (Pavey et al., 2018), the authors found that proscriptive messaging worked to convince moderate drinkers to only drink within government guidelines, but for heavy drinkers, the proscriptive messaging resulted in reactance to the constraint on their choices, which resulted in those users drinking more alcohol than their baseline at the beginning of the study. A prescriptive message, however, resulted in the heavy drinkers reporting less alcohol consumption, but this messaging was less effective for the moderate drinkers. A study by Janoff-Bulman, Sheikh & Hepp, (2009) found that proscriptive messaging relays information as mandatory and absolute. For those who already drank in moderation, this type of messaging further reinforced those behaviors, but caused reactance in those who drank more heavily, possibly because they felt it was their right and that their rights were being infringed upon by the stricter proscriptive messaging than by the more suggestive prescriptive messaging. Relating to our study, for those photographers that already followed guidelines not to flush the birds, our proscriptive interventions did not cause reactance, but for the cohort that were causing disturbance, our requests for them to stop caused them to ‘double-down’ on the negative behaviour.

On several occasions we observed photographers and birders and other recreational users who were following ‘the rules’ (i.e. staying on the dyke; avoiding the Shorebird Resting Beach and the two non-Shorebird Resting Beaches) yell down to photographers they saw stalking the birds on the beaches for photographs. A couple even took photos of the offenders and their license plates so that they could report them to the NS Department of Lands and Forestry (NSDLF). Several users also suggested that we put the NSDLF and/or the Environment and Climate Change Canada Conservation Enforcement phone number on our signage so that users not

following the rules could be reported. Another study of prescriptive norms and social control concluded that people (in our case photographers who are following the rules), will be more likely to try to control the social behaviour of (non-complying photographers) when they fear that they will be associated with the deviant behaviours (Brauer & Chaurand, 2010). This means that if photographers who are following the rules fear they will be painted with the same brush as those seen as causing disturbance, they will be more likely to try to curb the behaviours of the rule-breakers.

### **3.4.1 Recommendations for future work**

Disturbance events by photographers could perhaps be reduced by asking them to stay a certain distance from the birds, as recommended by Murchison et al., (2016), and to employ telephoto lenses to get ‘close-up’ shots. In interactions during this research, photographers and birders would often relate stories of other user groups disturbing the birds, while only one of those interviewed self-reported disturbance. This could be a result of self-favoring bias (Peters et al., 2014). Information and education aimed at this group may prove difficult, as they are knowledgeable about the birds and believe themselves to be stewards and experts (Manning, 2003).

When approaching users to ask them to avoid disturbing shorebirds, it is important to approach all recreational user groups equally, so that none feel persecuted or that others are treated preferentially. In our case, believing that photographers would be inherently more concerned with not flushing the birds than anglers, in 2017 we tried asking one photographer to come up off one of the non-resting beaches. Since we were not asking the anglers to leave the beach, this created animosity between this photographer and our researchers, which spread to other on-site photographers and resulted in more photographers causing disturbance to the birds on the non-

Resting Beaches. Had we instead treated all beach users equally, simply by explaining why it was important not to disturb the birds and letting users choose how they used that information, it may have brought these photographers to our cause, rather than alienating them.

Targeted messaging is likely required to shift the ‘cultural norms’ of shorebird photographers. A set of best practices following the Audubon Guidelines for Ethical Photography (Audubon, 2018) could be introduced on Facebook and Instagram bird photography pages, such as the Nova Scotia Bird Society Facebook page, whereby only those photographers clearly following the rules can post. There is an Instagram account called EthicalOwl that follows this practice (Birdingwild, 2018). An EthicalShorebird account could be created and managed in the same vein, only allowing those that list the telephoto lens and the buffer distance they used to post photos. However, it may be hard to prove that a photo was taken as indicated, and impossible to know that no birds were flushed in the process. Another work-around for photographers not wanting to abide by these rules would simply be to post on alternate pages that do not have such requirements.

In this vein, perhaps a marketing campaign targeted to photographers with a catchy, cheeky slogan might work, like “Flushing is for Toilets!” (Coreynimmer, 2018). It would serve as both an educational piece to help people understand that flushing is bad for the birds and could perhaps be used as a gentle rebuff from beach users who follow the rules to those who got too close, as in “Remember, flushing is for toilets!” The cases we saw of rule-following photographers trying to curb the behaviours of rule-breakers supports the idea that new norms put in place as a result of our study may result in a certain degree of self-enforcement among and between user groups on site, which would reduce Birds Canada or provincial departments’ financial investments in maintaining the Shorebird Resting Beach.

Another strategy could be the installation of photographer blinds on the dykes above The Guzzle beaches, where photographers would be encouraged to stay in order to take photos. The blinds would require policing and maintenance, and usage may be hard to enforce because we would be asking the photographers to use the blinds and not go down to the beach, while the anglers would still be fishing from the beach. Without legal authority to ask everyone to leave the beach during high tide periods in August, there would be little that could be done to remedy this double standard.

### **3.5 Conclusion**

Recreational beach users can have a negative impact on the migratory requirements of shorebirds. When we chose to set aside one beach to allow shorebirds to rest during high tide, we assumed that we would have push-back from striped bass anglers, the most numerous group on site, but we were not prepared for issues with shorebird photographers, who often see themselves as stewards of the birds. Photographers caused the second highest hourly rates of disturbance overall in 2017/2018 across the three beach sections, after anglers. This makes both groups worthy of more time and attention in future collaborative conservation work involving shorebirds. Managers need to be aware of the energetic outputs to migratory shorebirds that photographers can have when they flush the birds. Compounded disturbance from all photographers vying for the ‘perfect shot’ across these migratory shorebirds’ long range adds up, and adversely affects their ability to complete their migration to South America (Knight & Cole, 1995; Murchison et al., 2016).

The effects of peer pressure and social norms on reactance, and the boomerang effect within the photographer peer group was apparent in this study. The ‘cultural norms’ of shorebird photographers need to be shifted so that flushing the birds becomes a *faux pas*. This could be

accomplished through the implementation of best practices or a marketing campaign targeting photographers with catchy slogans. Peer pressure might be another viable solution, whereby those following the ‘rules’ explicitly encourage others to do the same. It was found in a study of social norms within peer groups that members are affected by peer pressure when their behaviours are not compliant with the norms of the group (Moti & Spiro, 2017). The authors also found that norms that were rejected by society at large were strictly followed within the peer group. This implies that photographers not following the norms of the photographer peer group would perceive peer pressure. If Space to Roost exerted new norms of behaviour that the majority of the photographer group complied with, these non-compliers could perceivably feel excluded, leading to anger, which might lead to reactance against the Space to Roost norm, and/or ‘boomerang’ them from the norm of not disturbing the birds, to refusing to stop disturbing the birds.

When managers or researchers are trying to enforce best practices, it is important to remember to approach all users equally, so that none feel unfairly targeted. Awareness of self-identify bias is also important, to understand how people see themselves and how pointing out their errors may result in them reacting against the established Space to Roost norm of not disturbing the birds at high tide, rather than changing their behaviour in a positive way.

Despite these challenges, the expansion of the Shorebird Resting Beach strategy to other areas of the Bay of Fundy and beyond should hopefully result in fewer human-caused disturbances to these birds during roosting times. This strategy will at least result in greater awareness of both the birds’ migratory requirements, as well as what individuals can do to afford them that space.

Many factors contribute to global declines in migratory shorebird populations. Disturbance is one such factor that threatens shorebirds across their range, as it impacts the birds’ ability to

acquire sufficient fat stores to complete their migration from the Arctic to South America. At high tide, when their feeding grounds are covered, the birds rest, but this is also the most popular time for people take pictures of the birds or fish. This intersection of requirements for limited space results in shorebird disturbance. Finding ways to work collaboratively with these groups causing the greatest hourly rates of disturbance to inspire them to change their behaviours may just help to redress global declines of these important species.

## CHAPTER 4: CONCLUSION

### 4.1 Overview of the study

This thesis examined the results of a three-year study called ‘Space to Roost,’ which focused on migratory shorebird disturbance by recreational users during high tide roosting periods at The Guzzle, NS. From August-early September 2016, baseline site audits of beach users and bird disturbance were conducted around the high tide, showing that the West Beach had the highest numbers of shorebirds and lowest number of recreational users. Coupled with user engagement—including verbal surveys of and informal conversations with on-site users, and a Facebook survey of striped bass anglers—this information was used to choose one of three beaches as a ‘Shorebird Resting Beach,’ to be voluntarily left for roosting shorebirds within two hours of high tide in August in 2017 and 2018. The results of the 2016 audits and accompanying maps were used as a baseline to compare with results obtained from audits and surveys in those two years.

Space to Roost employed collaborative conservation, human dimensions of wildlife management and social normative theory as its theoretical frameworks. Collaborative conservation “emphasizes local participation, sustainable natural and human communities and voluntary consent and compliance over enforcement by legal and regulatory coercion” (Wyborn, & Bixler, 2013 p. 59 citing Snow, 2001). Researchers of human dimensions study the human behaviours that have negative impacts on wildlife, asking why these behaviours occur and how they might be curbed to reduce or eliminate impacts (Kerlinger, 1993). Social normative theory helps to understand influences on human behaviours and how people will, and believe they should behave in a given situation (Brauer & Chaurand, 2010; Cialdini, Reno, & Kallgren, 1990).



In this study, we tried to bring users to the table and develop collaborative conservation results. We also presented the project to local groups and local and international conferences with interactive question and answer periods, set up and regularly updated a Facebook page, and posted the 2016 results on-site and on Facebook. We held a shorebird viewing party and yoga class, conducted television interviews, took part in a documentary, and published results and information on what to do and how to get involved in local newspapers, newsletters, and the international periodical *Birder Watcher's Digest*. Despite these efforts, there were persistent challenges in engaging recreational beach users in collaborative conservation strategy development.

The findings of the Space to Roost project will help inform decisions surrounding recreational beach use during shorebird migration, and although this research is focused in the Minas Basin of the Bay of Fundy, the conclusions can be employed by conservation managers in other areas where migratory shorebirds stop to rest and refuel. This study contributes to the body of knowledge by helping natural resource managers make better decisions as to how to best control beach use during peak shorebird migration. The results of the study could be used to improve policy in regards to shorebird conservation.

## 4.2 Primary Research Questions Revisited

The research questions that this thesis sought to answer are listed here, and addressed in turn below:

1. Did collaborative conservation design and implementation affect shorebird disturbance, and if so, how?
2. What lessons do the pilot test of the co-designed initiative hold for conservation with anglers and other recreational beach users, or collaborative conservation more generally?

### 4.2.1 Did collaborative conservation design and implementation affect shorebird disturbance, and if so, how?

Reducing the ‘knowledge deficit’ of users to shorebirds’ roosting and migratory requirements demonstrates how collaborative conservation design and implementation helped to reduce shorebird disturbance. It is clear from our survey results that knowledge increased because of this program, which suggests that there is value in filling the ‘knowledge deficit’ of beach users to help champion safe roosting space for shorebirds. In particular, the increase in the number of people who knew the importance of the spot to migrating shorebirds from pre-to-post conservation strategy suggests our educational campaign had some measure of success. There are of course many factors that could account for these numbers, as we could have randomly chosen survey respondents with more or less knowledge of shorebirds from one year to the next, or those with more interest in the birds may have self-selected, and therefore were not representative of the average beach user.

A second indicator of the success of the collaborative conservation strategy, which links back to the increase in user knowledge from pre-to-post Resting Beach implementation, is the reduction in the number of users choosing to go down to the Shorebird Resting Beach from the dyke

above, dropping from just over half of all users before the conservation strategy in 2016, to less than 10% in 2017 and 2% in 2018 (Figure 6). Most stayed on the far side of the sign, and a large group of users would often congregate there to watch the birds on the beach below. These results bode well for the Shorebird Resting Beach strategy, as it proves that when given the information and a choice, most users will choose to avoid causing disturbance. From their study of psychological science in conservation, Clayton, Litchfield & Geller, (2013), found that people often copy the behaviour of others, rather than making conscious behavioural changes themselves. The authors also found that approval by peers was a powerful enforcer of behaviour. In management settings requiring behavioural change, admired peers can be recruited as ‘ambassadors’ so that others follow their positive behavioural example and are less likely to demonstrate undesirable behaviours, in fear that this could result in negative interactions with their peers (Stein, 2018). This could explain why some users chose to stay on the dyke when a large group of recreational users were present, either copying the behaviour or not wishing to ‘get in trouble’. Following the behaviour of others, rather than making a conscious choice, could also explain the behaviour of users who went down to the Resting Beach when they saw others doing it, despite our signage and researcher presence. Such influences are known as descriptive norms, which are “what most people do in a particular situation, and they motivate action by informing people of what is generally seen as effective or adaptive behavior” (Reno et al., 1993, p.104). On one occasion, two anglers were fishing on the Resting Beach, and a photographer followed them down. When we talked to her upon her return, she said she had not even noticed the signs, just saw others on the beach and decided to follow them. Since human use is the only variable we can (try to) control in our efforts to reduce disturbance to shorebirds, this example

illustrates why getting as close as possible to 100% compliance is so important; if one person chooses not to comply, others will follow.

Another clear success of this collaborative conservation strategy was the reduction in disturbance by walkers as a result of our signage installation in 2017/2018. This was most likely because many of the walkers we audited at The Guzzle in 2016 were tourists and locals who arrived and decided to walk on the beach as a spur of the moment decision. For such users, signage asking them to avoid the beach was enough to dissuade them, because their decision to walk there was opportunistic and easily replaceable by an alternate path, or a substitute on-site pastime. For the tourists, their decision not to walk on the beach could also be due to the fact that because they were from away and did not see themselves as experts of the site or the birds, they accepted and complied with the information presented in the signs and by the researchers. This possibility is supported by Manning (2003) who found that information/education programs aimed at visitors who have less experience or knowledge of a subject are more open to the information than those with more knowledge/experience. Walker disturbance incidents were so greatly reduced between years because walkers were more open to the new information presented in the signs. In addition, unlike anglers who have limited locations from which to fish, and birders and photographers, who came specifically for the birds, walkers can easily choose alternative locations.

#### **4.2.2 What lessons do the pilot test of the co-designed initiative hold for conservation with anglers and other recreational beach users, or collaborative conservation more generally?**

##### *Social normative theory and non-complying anglers*

In the second year of the Shorebird Resting Beach strategy (2018), the data show a decrease in effectiveness on the Resting Beach among anglers. Although they caused no disturbances in 2017 or even in 2016, this was not the case in 2018. Claiming a right over site usage is a possible

explanation, as two of the anglers told the lead author that they “Had been coming here for 20 years” (the implication being that they were entitled to do as they wished on site). The application of social normative theory, in particular prescriptive and proscriptive norms, was not successful with the five anglers that chose to use the Resting Beach in 2018. Prescriptive norms are those behaviours one is expected to comply with, while proscriptive norms are those behaviours with which one is not supposed to engage. In our study, the prescriptive norm (‘do this’ message) was that beach users leave the Shorebird Resting Beach for roosting shorebirds during high tide. None of the five anglers who caused disturbance on the Resting Beach in 2018 were persuaded to leave the beach by other users self-enforcing Space to Roost proscriptive norms by yelling down to him to come off the beach. This attempt to exert proscriptive norms (e.g. peer pressure) was exemplified in a study of pre-and-proscriptive norms and social control (Brauer & Chaurand, 2010), that found that people are likely to try to control the social behaviour of their peers when they fear that they will be associated with the deviant behaviour. Possible explanations for these anglers’ imperviousness to their peers’ recriminations might be explained by reactance, described as “the desire to engage in the opposite behaviour to that being advocated as a form of protest” by Sussman & Gifford (2012, p. 597 citing Brehm, 1966). There has been some evidence to suggest that people react more forcefully to proscriptive norms than prescriptive because they perceive the latter as being more coercive or regulatory (Pavey et al., 2018). It is also possible that the imposition of proscriptive norms on these users by their peers caused the boomerang effect, whereby messaging created with one purpose results in the opposite behaviour, as in anti-smoking ads that resulted in more people choosing to smoke (Hart & Nisbett, 2012). The pushback may represent the Facebook survey respondents who were determined to continue fishing on all three Guzzle beaches, or it is possible that these anglers

were willing to play along for one year but were worried they would lose more ground as time went on. Future conservation programs should avoid proscriptive messaging, because it is perceived as being more coercive or regulatory than prescriptive messaging (Pavey et al., 2018). It is also counter to our collaborative conservation framework, which sought to engage and partner with users in a non-coercive, non-regulatory manner (Wyborn & Bixler, 2013 p. 59 citing Snow, 2001). Messaging perceived as being absolute has been shown to result in feelings of resentment and anger, (Rofes, 2002), which in turn causes users to react or boomerang in the opposite direction from the conservation aim, which ultimately harms the conservation subject (the shorebirds).

#### *The problem with assumptions*

An important lesson learned about collaborative conservation and human dimensions of wildlife management involves not bringing one's own assumptions into the execution of the strategy. The lesson also pertains to the importance of approaching all recreational user groups equally.

Although some photographers on-site caused disturbance to shorebirds, only one disturbed birds on the Shorebird Resting Beach in 2017, and none in 2018. At the beginning of this study, we were not prepared for disturbance by bird photographers, and did not even have a category for them, instead combining them with birders. After seeing disturbance by photographers in 2016, the category was added, though it was assumed that they would have a conservation mentality in line with Space to Roost, and that the messaging would be translated to and followed on the two non-Resting Beaches by this group. Although the majority did remain on the dykes as expected, small groups of photographers moved from the dykes to the non-Resting Beaches, flushing the birds as they got ever closer to their subjects. Of course, the Resting Beach strategy was not designed to change behaviour on the non-Resting Beaches, and so the assumption turned out to

not only be incorrect, but also damaging. In 2017, a group of self-enforcing users, attempting to enforce our social prescriptive norm of voluntarily leaving the beach for shorebirds at high tide, began employing the proscriptive norm of telling photographers not to use the non-Resting Beaches by yelling down to them to get off the beaches. They also took photographs of their licence plates, in order to report them to NSDLF. When this tact was not successful, they asked the author to tell a photographer on Middle Beach to come back up to the dyke, which the author did. This was a mistake, because it created a great deal of animosity with that photographer, that then spread to others in a local photography group. As was the case with the five anglers, changing the prescriptive norm (do this) used in our signage and handouts to a proscriptive norm (do not do this) by asking the photographer to come off a non-Resting Beach, resulted in feelings of resentment and anger (Rofes, 2002), which in turn resulted in reactance and the boomerang effect. In addition, asking this user to leave the beach while not requesting the same of the anglers was an obvious double standard which was damaging to the project. This is evidenced by the data that show that the hourly rate of disturbance by photographers more than quadrupled from 2017 to 2018 on the non-Resting Beaches. The negative reaction by this and other photographers resulted in a stronger self-serving judgement that they were in fact not harming the birds, and that they had as much right to the non-Resting Beaches as the anglers, which is true. This may also explain why, after speaking to a few of the photographers on the dykes in 2017, we saw the same photographers in 2018 again following groups of birds until they flushed a short distance away, then following them again, continuing this until the birds finally flushed and did not return. Anglers and walkers were also observed flushing the birds repeatedly but less intentionally as they moved along the beaches; photographers are often specifically interested in the aesthetics of the flushing birds (see Chapter 3). For the photographers, our explanations that

their behaviour was harmful to the birds was damaging to their self-judgement, so they did not heed them. Future researchers/interpreters should be consistent when asking any particular user group to avoid disturbing shorebirds, and to be cautious of making assumptions as to how any particular group will or should act.

### *The role of prescriptive and proscriptive messaging in self-enforcement*

The examples above of rule-following users trying to curb the behaviours of rule-breakers (both anglers and photographers) give credence to the idea that new norms put in place as a result of the Space to Roost project may result in a certain degree of self-enforcement among and between user groups on site. This would reduce Birds Canada or provincial departments' financial investments in maintaining the Shorebird Resting Beach. Future projects could also add conservation enforcement phone numbers to their signage so that users can report users on designated Shorebird Resting Beaches, or those causing disturbance/harm more generally.

Although our study found that proscriptive peer-pressure caused reactance, the efficiency of our Space to Roost program was found to be improved by prescriptive peer-pressure, whereby users saw other users following the social prescriptive norm of voluntarily staying off the Resting Beach during high tide roosting periods, and followed suit (Chen et al., 2012). This result was illustrated in our data that showed the hourly rate of users choosing to go down to the Shorebird Resting Beach from the dyke above drop drastically from 2016 to 2017 and 2018.

### *Why boots on the ground are needed*

Despite the evidence of shifting social norms described above, the importance of on-site personnel cannot be overstated. Due to funding constraints, we were not able to be present every day in August, but a full-time onsite interpreter, as is the model at Johnson's Mills Shorebird Interpretative Centre in New Brunswick, might be a good solution to this problem at The Guzzle.



In addition, users may have changed their behaviours on days when we were present, as they knew what we were expecting of them, and so may have caused more disturbance on days that we were not present. There is anecdotal evidence to support this, as we were told that anglers and others went down to the Resting Beach when we were not present.

### *100% compliance is not possible*

Another lesson learned was that 100% compliance can never really be attained. As such, addressing the small percentage that knowingly caused disturbance was a challenge we were not able, and most likely would never be able, to completely overcome. Although our engagement methods undoubtedly reached many in our target audiences, and successes of this outreach can be seen in our results, the cohort of users that were not interested in our messaging were not swayed to change their behaviour.

### *Improving the signage*

The signage proved quite effective, especially for walkers, but it may be wise to change the look of the signs periodically to ensure people continue to notice them. It may be useful to continuously update the signage with new information and imagery, alter their shape, or add eye-catching adornments to keep people looking at them and reading the messaging. It is also important to continue to only install them from mid-July to mid-September, to increase the likelihood that people will continue to notice them. Otherwise, the decreasing efficacy in the second year of our study suggests that beach users may begin to filter them out. We put images of the birds on our handouts, but perhaps it would be beneficial to also add them to the signs, or to make a Semipalmated Sandpiper caricature that speaks directly to the user, as on the front page of our handout (Appendix C). Ballantyne & Hughes (2006) found that users liked signs that allowed them to draw a personal connection to the birds and understand how their behaviour

affected them. In the same study, users also appreciated information about alternate dog-walking or recreational sites, which would be a useful addition to our signage, especially for tourists and local dog walkers. Adding images of buffer distances to the signage might be prudent (e.g. Olympic swimming pools), so that people can visualize how far away they need to be.

#### *The challenge of measuring collaborative conservation impacts*

It is hard to create a study that tracks human behaviour and its impact on shorebirds, and it is also hard to know what role engagement and collaboration plays; that is, whether or not the conservation goal is being achieved through engagement and collaboration, in whole or in part. Indeed, others have found that evidence to support the theory that public participation improves environmental results tenuous at best (Bäckstrand et al., 2010). In many cases, the spread of collaborative conservation ideas has surpassed the ability of organizations, academics and governments to adequately assess the effectiveness of these collaborations in the improvement of conservation challenges (Clement et al., 2020).

#### *Engaging a varied group of stakeholders is difficult but essential*

Our study suggests that the engagement of a varied group of stakeholders is needed in order to be effective, as is the case with many studies that seek to foster collaborative conservation to address complicated ecological issues (Clement et al., 2020). A major issue with our study, and a lesson learned for future work, is that it was easy to miss engagement with key users, as there was no ‘one-stop-shop’ in which to reach out to everyone on site. The only connection between the majority of users were that they were at The Guzzle at the same time that we were. There was no established stakeholder group that we could contact to get in touch with all of the users. Some photographers might belong to the Blomidon Naturalists Society, and some anglers might belong to the NS Hunters and Trappers Association, but unless users agreed to give us their contact

information, there was no way to reach the majority. Bäckstrand et al. (2010) found that collaborative engagement outreach is mainly geared toward well-known stakeholder groups that are highly organized, like registered charities, academic institutions and governments. They found that other groups with a looser structure (say a photography group or a couple of anglers that always meet at the same beach at the same time) are less likely to be noticed and so are less likely to be recruited to help make decisions. Unfortunately, Bäckstrand's point was well illustrated by our study: there was no one we engaged on site who sat on the Minas Basin shorebird conservation partners "Space to Roost" planning group. This group was made up entirely of government, academic and Birds Canada partners, and members of the highly organized Blomidon Naturalists Society's IBA Stewardship Committee.

### **4.3 Recommendations for further work**

This section will outline eight recommendations for future work that were revealed throughout the Space to Roost project.

#### *Categorizing shorebird-human avoidance as disturbance*

Throughout the study, there were many instances of anglers and others stationed on the beach when the birds arrived, so the beach was essentially lost to them for the duration of the users' stay, and the birds had to fly around to find an alternate resting space. We only counted disturbances where birds were present and were disturbed by humans, but perhaps human presence upon shorebird arrival could be categorized as a disturbance type related to shorebird-human avoidance. On East Beach, where anglers were often present during the entire high tide period, shorebird numbers were consistently low, which suggests that the continued presence of humans at high tide throughout peak migration in August dissuaded shorebirds from landing and utilizing this beach as a roosting site at high tide. The energetic output of the birds that never

landed due to human presence were not counted as disturbance in this study but are very important and should be counted in future studies. The omission of these data in our study resulted in counter-intuitive results, whereby large numbers of users were counted on a particular beach, but no birds were counted as disturbed during those periods. This is not because the users were changing their behaviour to accommodate the birds, but because the birds were not landing because of human presence. It was obvious through observation of the human users and birds that this loss of roosting time was considerable across all three beach sites and is a concern that should be addressed in future studies. It would be hard to quantify the energetic loss of this disturbance, as it would be impossible to know if the birds spent the entire period flying (which would be very energetically taxing), or if they found an alternate roosting location a short distance away (less taxing). Neima (2016), used stable isotope analysis and radio-telemetry to assess diet and track movement of Semipalmated Sandpipers in the Bay of Fundy in her 2016 thesis, and her supervisor Diana Hamilton at Mount Allison University's shorebird lab would be a good partner for further research into the energetic costs of disturbances as a result of shorebird-human avoidance.

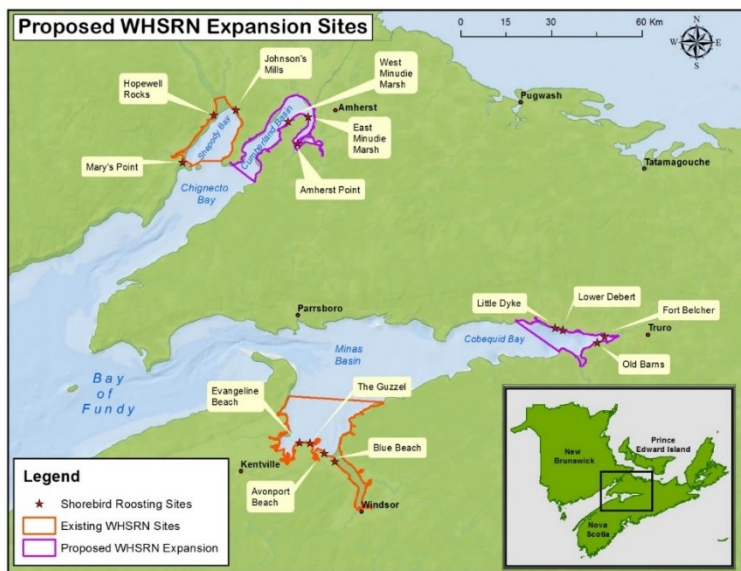
#### *Accounting for the proportion of birds disturbed of total birds present*

One limitation of a study design counting every incidence of disturbance throughout the audit period, but only counting the number of birds present every 30-minutes, was that it made it hard to analyze the data and understand how many birds were disturbed of total birds present. We were not able to assess proportion because there may have been no birds present during the previous spot check, but during the thirty minutes before the next check, birds could land, be disturbed, and leave again, so would not be counted within either spot check. Thus, it was impossible to come up with a true proportion of birds disturbed of total birds present. This

proportion would have helped us explain instances when no birds were disturbed simply because none were present. This flaw in our audit methodology should be corrected in future studies to get a true picture of disturbance, possibly by counting the number of birds disturbed and the total number of birds present at the time of each disturbance event.

*Testing the Shorebird Resting Beach strategy in other locations*

It would be wise to test the strategy’s efficacy in other locations. Birds Canada continued the Space to Roost program at The Guzzle and other sites within the Bay of Fundy in 2019. In 2018, the Nature Conservancy of Canada applied to the Western Hemisphere Shorebird Reserve Network (WHSRN) Council to nominate the Bay of Fundy as a Landscape of Hemispheric Importance. They plan to employ aspects of the Shorebird Resting Beach strategy in three additional areas in the Bay of Fundy, including Cobequid Bay in Nova Scotia and Shepody Bay and Cumberland Basin in New Brunswick (Figure 12).



**Figure 12:** Nature Conservancy of Canada’s proposed Western Hemisphere Shorebird Reserve Network (WHSRN) Expansion Sites in the Bay of Fundy, Canada.

Source: <https://www.natureconservancy.ca/en/where-we-work/nova-scotia/featured-projects/whsrn-expansion-project-1.html>

Beach users at our four sites in 2016 suggested we could add several nearby beaches that are popular with shorebirds and recreational users in future years of the study. A pilot in a densely populated area would also be a logical next step in the testing of this method, as our test site was naturally underpopulated and was chosen by users because it was underused and/or undervalued within the larger site. A heavily populated area where space is at a premium would be a good test of whether people are interested and able to share their beach space with shorebirds. There has been interest expressed in piloting the program in British Columbia, Georgia, Maine, New Jersey, New Brunswick and Newfoundland, as well as in the wider Western Hemisphere Shorebird Reserve Network. The signage, handouts and surveys have already been adapted for similar work in Maine, Nova Scotia, New Brunswick, and Newfoundland.

*Examining the interactions of disturbance between beach, year, and disturber type*

Complex statistical modelling that elucidates the interactions of disturbance between beach, year and disturber type may hold the answers to some of our persistent and unanswered questions. Was the Shorebird Resting Beach truly successful in reducing disturbance by human and non-human users, or did it simply displace the disturbance to the other two beaches on site and to other staging areas? Did the higher concentrations of human users on the non-Resting Beach beaches cause more disturbance than if they were spread out over the three beaches? The fact that disturbance was, for the most part, higher on the non-Resting Beaches in 2017/2018 than 2016 may point to this, though again, with so many contributing factors it is hard to know for sure.

*Choose a Shorebird Resting Beach for both conservation and methodological reasons*

The small number of people using the West Beach in 2016 was one of the reasons it was chosen to be the Shorebird Resting Beach, as it would disturb fewer people, and was certainly the best choice from a shorebird conservation perspective. However, the small number of people using this beach was also a methodological limitation, as it meant that the differences in usage from 2016 to 2017 and 2018 were not high enough to show clear differences between beaches, and in some cases inadvertently showed that disturbance was zero in 2016 (with anglers for example) and non-zero in another year, which made the strategy appear ineffective for that cohort.

Another consideration in choosing a Resting Beach is to ensure it has enough beach space at high tide for shorebirds to have adequate space to roost, and allows them a 360-degree view. Our Resting Beach lost almost all of its beach space to the high tide, and as it was abutted by a dyke, did not afford the birds a clear view around themselves, so they often flushed needlessly as the tide came in.

A methodological flaw of our study was not distinguishing whether recreational users were on the dyke or on the beach within the Shorebird Resting Beach section. This should be corrected for future studies, both for the Resting Beach and control non-Resting Beaches.

*What causes a flock to flush multiple times in a row?*

Future studies should look into what causes a flock to flush multiple times in a row from a single source of disturbance. A couple of possibilities include: that the location did not afford the birds a 360-degree view of their surroundings, which made them nervous; that as the tide went out, the birds became restless to return to their feeding grounds; or that a few nervous birds continuously signaled a false sense of danger to the flock and caused them to flush. Another possibility could

be the width of the available beaches, as Murchison et al., (2016) found that shorebirds spent longer periods of time at wider beaches.

*Can 'unknown' disturbances be broken down into more useful sub-categories?*

Further research into what we classified as 'unknown sources of disturbance' would be prudent, including breaking this category down further, perhaps showing "Source of disturbance missed by researcher," "Non-specific human disturbance," "Non-specific non-human disturbance", and "Human disturbance from outside/adjacent the study site" (e.g. the farm vehicle noise).

*Do fast moving users cause greater hourly rates of disturbance?*

Another factor which we did not measure was whether shorebirds were disturbed more often by fast moving users. This has been tested in several other studies, with consensus being that birds are disturbed at a greater hourly rate by fast moving sources of disturbance, such as joggers, running dogs, fast moving boats, etc. (Murchison et al., 2016; Suffolk Coast and Heaths 2012; Baudains & Lloyd 2007; Blumstein 2003).

#### **4.4 Conclusion**

Shorebird Resting Beaches show potential as a useful tool when managers wish to reduce conflicts between the needs of shorebirds and the desires of recreational users.

The substantial drop in the number of users choosing to go down to the Shorebird Resting Beach throughout the study was heartening. This drop proves that signage and researcher explanations of shorebird roosting requirements are effective deterrents for the majority of users. The usefulness of signage, handouts and researcher presence was further supported by the increase in user knowledge about shorebirds and their migratory requirements.



It is important that dedicated staff be employed on Resting Beaches, to explain the needs of the shorebirds and why it is so important to give them 'Space to Roost'. Otherwise, it is too easy for users to simply ignore or miss the signage and handouts. Staff must be cautious of making assumptions as to how any particular group will or should act, and be consistent with all users when asking them to avoid disturbing shorebirds. This is because even with a combination of signage, researcher presence, education and outreach, users who feel a sense of ownership or entitlement over the site will most likely not be swayed to change their behaviour, and negative interactions with staff will push them further from management objectives, and may encourage others to follow their lead.

Overall, we had mixed success in trying to deal with human-shorebird conflicts by empowering users to be a part of the solution. We found that 100% compliance on the Shorebird Resting Beach was unobtainable, and for a small subset of the population, Resting Beaches in the form outlined in this thesis are not effective. Although we tried to reengage with anglers, photographers, and others each year, we found accessing the members of these groups challenging, and even in the case of users we did reengage with, results were mixed. Ideally, a yearly Facebook survey or focus group would help with reengagement, where users could consider the results of the project together with managers, derive solutions, and foster self-peer monitoring and compliance.

With interest in this conservation strategy from many other groups both nationally and internationally, the program will be tested in other areas with improved methodologies, which is an important step in assessing its efficacy. When managers or researchers are trying to enforce best practices in future studies, it is important to remember to approach all users equally, so that none feel unfairly targeted. Awareness of self-identity bias is also crucial, to understand how

people see themselves and why making assumptions about their behaviours or ways of thinking may result in them moving farther away from the behaviours we hope to instill.

There are myriad issues contributing to declines in migratory shorebird populations, including climate change, harvesting, degradation of habitat and coastal developments. Disturbance is another threat to shorebirds across their range, as it impacts the birds' ability to acquire fat stores at stopover sites to complete their migratory journey. The birds' roosting time in August coincides with the most popular time for people to use the beaches for recreational purposes, which results in disturbance. Although reducing individual disturbances may not seem to make much of a difference, if all users across their migratory range changed this behaviour, it might just give these species the chance to battle some of the more pressing issues they face.

## REFERENCES

- Annis, G. M., Pearsall, D. R., Kahl, K. J., Washburn, E. L., May, C. A., Franks Taylor, R., ...  
Doran, P. J. (2017). Designing coastal conservation to deliver ecosystem and human well-being benefits. *PloS One*, *12*(2). <https://doi.org/10.1371/journal.pone.0172458>.
- Aronson, E., & O’Leary, M., (1982). The relative effectiveness of models and prompts on energy conservation: a field experiment in a shower room. *Journal of Environmental Systems* *12*, 219.
- Aubry, Y., & Cotter, R. C. (2007). *Plan de conservation des oiseaux de rivage du Québec*. Service canadien de la faune, Région du Québec.
- Audubon. (2018). *Audubon’s Guide to Ethical Bird Photography*. Retrieved from <https://www.audubon.org/get-outside/audubons-guide-ethical-bird-photography>.
- Bäckstrand, K., Khan, J., Kronsell, A., & Lövbrand, E. (2010). The promise of new modes of environmental governance. *Environmental politics and deliberative democracy: Examining the promise of new modes of governance*, 3-27.
- Ballantyne, R., & Hughes, K. (2006). Using front-end and formative evaluation to design and test persuasive bird feeding warning signs. *Tourism Management*, *27*, 235–246. <https://doi.org/10.1016/j.tourman.2004.09.005>

Bardati, D. R., & Bourgeois, C. (2008). Barriers to Collaborative Nature Conservation Efforts in Rural Energy Corridors: A Case Study in Southern Quebec. In J.W. Goodrich-Mahoney, L.P. Abrahamson J. L. Ballard and S. M. Tikalsky (Eds.), *Environmental Concerns in Rights-of-Way Management: Eighth International Symposium* (pp. 739–751). Boston: Elsevier.

Baudains, T. P., & Lloyd, P. (2007). Habituation and habitat changes can moderate the impacts of human disturbance on shorebird breeding performance. *Animal Conservation*, *10* (3), 400–407. <https://doi.org/10.1111/j.1469-1795.2007.00126.x>

Birdingwild (2018). Ethical Owl Photos. [Instagram account]. Retrieved from <https://www.instagram.com/ethicalowlphotos/>

Blumstein, D. T. (2003). Flight-Initiation Distance in Birds Is Dependent on Intruder Starting Distance. *The Journal of Wildlife Management* *67*(4), 852-857. Retrieved from <https://www-jstororg.ezproxy.library.dal.ca/stable/pdf/3802692.pdf?refreqid=excelsior%3A4ead835d3bede863c55f3006432ba720>

Boyle, S. A., & Samson, F. B. (1985). Effects of Nonconsumptive Recreation on Wildlife: A Review. *Wildlife Society Bulletin* *13*, 110-116.

Brauer, M., & Chaurand, N. (2010). Descriptive norms, prescriptive norms, and social control: An intercultural comparison of people's reactions to uncivil behaviors. Retrieved March 28, 2020, from <https://onlinelibrary-wiley.com.ezproxy.library.dal.ca/doi/epdf/10.1002/ejsp.640>

- Brehm, J.W., (1966). *A Theory of Psychological Reactance*. Oxford, England: Academic Press.
- Brewer, M. B (1979) In-group bias in the minimal intergroup situation: A cognitive motivational analysis. *Psychological Bulletin*, 86, 307-324.
- Brewer, M B., & Kramer, R M (1985) The psychology of intergroup attitudes and behaviors. *Annual Review of Psychology*, 36, 219-244.
- Brown, J. D. (1986). Evaluations of self and others: Self-enhancement biases in social judgments. *Social Cognition*, 4(4), 353–376.
- Brown, S., Gratto-Trevor, C., Porter, R., Weiser, E. L., Mizrahi, D., Bentzen, R., ... Giroux, M.-A. E. (2017). Migratory connectivity of Semipalmated Sandpipers and implications for conservation. *American Ornithological Society* 119, (2), 2017-224.  
<https://doi.org/10.1650/CONDOR-16-55.1>
- Burger, J., Jeitner, C., Clark, & K., Niles, L. (2004). The effect of human activities on migrant shorebirds: successful adaptive management. *Environmental Conservation*, 31(4), 283–288.  
<https://doi.org/10.1017/S0376892904001626>
- Burger, J., & Niles, L. (2013). Shorebirds and stakeholders: Effects of beach closure and human activities on shorebirds at a New Jersey coastal beach. *Urban Ecosystem*, 16, 657–673.  
<https://doi.org/10.1007/s11252-012-0269-9>.
- Chen, X., Lupi, F., An, L., Sheely, R., Viña, A., Viña, V., & Liu, J. (2012). Agent-based modeling of the effects of social norms on enrollment in payments for ecosystem services. *Ecological Modelling*, 229, 16–24. <https://doi.org/10.1016/j.ecolmodel.2011.06.007>

- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, *58*, 1015–1028.
- Clayton, S., Litchfield, C., & Geller, S. (2013). Psychological science, conservation, and environmental sustainability. *Ecology and the Environment*, *11* (7), 377-382.  
<https://www.jstor.org.ezproxy.library.dal.ca/stable/pdf/43187634.pdf?refreqid=excelsior%3A6532f43388ab4493f3c4a7c82cc0a779>
- Clement, S., Gonzalez, A. G., & Wyborn, C. (2020). Understanding Effectiveness in its Broader Context: Assessing Case Study Methodologies for Evaluating Collaborative Conservation Governance. *Society & Natural Resources*, *33*(4), 462–483.  
<https://doi.org/10.1080/08941920.2018.1556761>
- Conservation Measures Partnership (CMP). (2013). *Open Standards for the Practice of Conservation*. Retrieved from [http://www.iaii.org/wpcontent/uploads/2015/08/CMP\\_Open\\_Standards\\_Version\\_3.0\\_April\\_2013.pdf](http://www.iaii.org/wpcontent/uploads/2015/08/CMP_Open_Standards_Version_3.0_April_2013.pdf)
- Coreynimmer (2018). Birds and Wildlife + Funny. [Instagram account]. Retrieved from <https://www.instagram.com/coreynimmer/>
- Cowx, I. G., Arlinghaus, R., & Cooke, S. J. (2010). Harmonizing recreational fisheries and conservation objectives for aquatic biodiversity in inland waters. *Journal of Fish Biology* *76*(9), 2194–2215. <https://doi.org/10.1111/j.1095-8649.2010.02686.x>

- Decker, D.J., Brown, T.L., & Mattfeld, G.F. (1989). The future of human dimensions of wildlife management: can we fulfill the promise? In *Transactions of the North American Wildlife and Natural Resources Conference* 54, (415–425).
- Decker, D.J., T.L. Brown, N.A. Connelly, J.W. Enck, G.A. Pomerantz, K.G. Purdy, & W.F. Siemer. (1992). *Toward a comprehensive paradigm of wildlife management: integrating the human and biological dimensions*. In *American Fish and Wildlife Policy: The Human Dimension*, ed., W.R. Mangun, (pp. 33–54). Carbondale, Illinois: Southern Illinois Press.
- Gratto-Trevor, C., Smith, P. A., Morrison, R. I. G., Aubry, Y., & Cotter, R. (2012). Population trends in Semipalmated Sandpipers from migration counts. *Waterbirds*, 35(1), 96–105
- Gray, S., & Jordan, R. (2010). Ecosystem-Based Angling: Incorporating Recreational Anglers into Ecosystem-Based Management. *Human Dimensions of Wildlife*, 15(4), 233–246.  
<https://doi.org/10.1080/10871209.2010.490972>.
- Hamilton, D. J., Diamond, A. W., & Wells, P. G. (2006). Shorebirds, snails, and the amphipod (*Corophium volutator*) in the upper Bay of Fundy: top–down vs. bottom–up factors, and the influence of compensatory interactions on mudflat ecology. *Hydrobiologia*, 567, 285–306.
- Hart, P. S., & Nisbet, E. C. (2012). Boomerang Effects in Science Communication: How Motivated Reasoning and Identity Cues Amplify Opinion Polarization About Climate Mitigation Policies. *Communication Research* 39(6), 701–723.  
<https://doi.org/10.1177/0093650211416646>

- Helmets, D.L. (1992). *Shorebird Management Manual*. Manomet, MA: Western Hemispheric Shorebird Reserve Network.
- Hernán, M.A., Hernández-Díaz S., Robins J.M., (2004) A structural approach to selection bias. *Epidemiology* 15(5), 615-25.
- Hicklin, P.W. (1987). The migration of shorebirds in the Bay of Fundy. *Wilson Bulletin*, 99(4), 540-570.
- Hicklin, P. W., Smith, P. C. (1984). Selection of foraging sites and invertebrate prey by migrant Semipalmated Sandpipers, *Calidris pusilla*, in Minas Basin, Bay of Fundy. *Canadian Journal of Zoology* 62, 2201–2210.
- Hitchcock, C. L. & C. Gratto-Trevor. (1997). Diagnosing a shorebird local population decline with a stage-structured population model. *Ecology* 78, 522-534.
- Hoffman, M. L. (1970). Moral development. In P. M. Mussen (Ed.), *Carmichael's manual of child psychology* (pp. 261–359). New York, NJ: Wiley
- Important Bird Areas (IBA) Canada. (n.d.). *IBA Site Summary: Southern Bight, Minas Basin, Bay of Fundy (near Wolfville), Nova Scotia*. Retrieved from <https://www.ibacanada.org/site.jsp?siteID=NS020>
- Janoff-Bulman R., Sheikh S., Hepp S., (2009). Proscriptive versus prescriptive morality: two faces of moral regulation. *J Pers Soc Psychol* 96, 521–37.



- Kerlinger, P. (1993). Birding economics and birder demographics studies as conservation tools. In Finch, D.M. & Stangel, P.W. (Eds.), *Status and management of neotropical migratory birds* (pp. 32-38). Washington, DC: USDA Forest Service.
- Klein, M. L. (1993). Waterbird Behavioral Responses to Human Disturbances. *Wildlife Society Bulletin 21*, 31-39.
- Knight A.T., Cowling R.M., Campbell B.M. (2006). An operational model for implementing conservation action. *Conserv Biol 20*(2), 408–19.
- Knight, R. & Cole, D. (1995). Wildlife Responses to Recreationists. In R. Knight & K. Gutzwiller (Eds.), *Wildlife and recreationists: coexistence through management and research* (pp. 51-69). Washington: Island Press.
- Kothari, A., Camill, P., Brown, J. (2013). Conservation as if People Also Mattered: Policy and Practice of Community-based Conservation. *Conservation and Society 11*(1), 1–15.  
<https://doi.org/10.4103/0972-4923.110937>
- Laist, D. W. (1997). Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records. In J. M Coe & D.B. Rogers (Eds.), *Marine Debris – Sources, Impacts and Solutions* (pp. 99–139.) New York, NY: Springer-Verlag.

- Livezey, K. B., Fernández-Juricic, E., & Blumstein, D. T. (2016). Database of Bird Flight Initiation Distances to Assist in Estimating Effects from Human Disturbance and Delineating Buffer Areas. *Journal of Fish and Wildlife Management*, 7(1).  
<https://doi.org/10.3996/082015-JFWM-078>
- Mann, H. (2015). *Diet, movements, behaviours and habitat use by Semipalmated Sandpipers (Calidris pusilla) in Cobequid Bay, Nova Scotia*. (Unpublished Honours Thesis). Mount Allison University, Canada.
- Manning, R. (2003). Emerging principles for using information/education in wilderness management. *International Journal of Wilderness*, 9(1), 20–28.
- Marcum, H. A. (2005). *The effects of human disturbance on birds in Bastrop State Park*. (Unpublished doctoral dissertation). Texas A & M University, USA.
- Méard, J., Bertone, S., Flavier, E., 2008. How second-grade students internalize rules during teacher-student transactions: a case study. *British Journal of Educational Psychology* 78, 395-410. doi:10.1348/000709907X264141.
- McShane, T. O., Hirsch, P. D., Trung, T. C., Songorwa, A. N., Kinzig, A., Monteferri, B., ... O'Connor, S. (2011). Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation*, 144, 966–972.  
<https://doi.org/10.1016/j.biocon.2010.04.038>

- Milner-Gulland, E.J., McGregor, J.A., Agarwala, M., Atkinson, G., Bevan, P., Clements, T. (2014). Accounting for the Impact of Conservation on Human Well-Being. *Conserv Biol.*, 28(5):1160–6.
- Morrison, R. I. G. & Hicklin, P. (2001). Recent trends in shorebird populations in the Atlantic Provinces. *Bird Trends*, 8, 16-19.
- Morrison, R. I. G., Downes, C., Collins, B. (1994). Population trends of shorebirds on fall migration in eastern Canada 1974-1991. *Wilson Bulletin*, 106, 431-447.
- Morrison, R. I. G. (1977). Use of the Bay of Fundy by shorebirds. In G.R. Daborn (Ed.), *Workshop proceedings–Fundy Tidal Power and the Environment*. (pp. 187-199). Wolfville, NS: Acadia University.
- Moti, M. & Spiro, D. (2017). From Peer Pressure to Biased Norms. *American Economic Journal: Microeconomics*, 9(1), 152-216.
- Murchison, C. R., Zharikov, Y., Nol, E. (2016). Human Activity and Habitat Characteristics Influence Shorebird Habitat Use and Behavior at a Vancouver Island Migratory Stopover Site. *Environmental Management*, 58(3), 386–398. <https://doi.org/10.1007/s00267-016-0727-x>
- Neima, S. (2016). Stopover ecology of semipalmated sandpipers *Calidris pusilla* during fall migration through the upper Bay of Fundy, Canada. (Unpublished masters thesis). Mount Allison University, Canada.

North American Bird Conservation Initiative (NABCI) Canada. (2019). *The State of Canada's Birds, 2019*. Environment and Climate Change Canada, Ottawa, Canada. 12 pages.

Retrieved from [www.stateofcanadasbirds.org](http://www.stateofcanadasbirds.org).

Ormsby, A. A., & Forys, E. A. (2010). The effects of an education campaign on beach user perceptions of beach-nesting birds in Pinellas County, Florida. *Human Dimensions of Wildlife, 15*(2), 119–128. <https://doi.org/10.1080/10871200903428366>

Pavey, L., Sparks, P., & Churchill, S. (2018). Proscriptive vs. Prescriptive Health Recommendations to Drink Alcohol Within Recommended Limits: Effects on Moral Norms, Reactance, Attitudes, Intentions and Behaviour Change. *Alcohol and Alcoholism, 53*(3), 344–349. <https://doi.org/10.1093/alcalc/agx123>

Peters, K. A., & Otis, D. L. (2007). Shorebird Roost-Site Selection at Two Temporal Scales: Is Human Disturbance a Factor? *Journal of Applied Ecology, 44*(1), 196–209. <https://doi.org/10.1111/j.1365-2664.2006.01248.x>

Peters, K., Daniels, K., Hodgkinson, G. P., & Haslam, S. A. (2014). Experts' Judgments of Management Journal Quality: An Identity Concerns Model. *Journal of Management, 40*(7), 1785–1812. <https://doi.org/10.1177/0149206311434532>

Randolph, J. (2004). *Environmental Land Use Planning and Management*. Washington, DC: Island Press.

- Reiter, S.M., Samuel, W. (1980). Littering as a function of prior litter and the presence or absence of prohibitive signs. *Journal of Applied Social Psychology, 10*, 45-55.  
doi:10.1111/j.1559-1816.1980.tb00692.x.
- Reno, R.R., Cialdini, R.B, & Kallgren, C.A. (1993). The transsituational influence of social norms. *Journal of Personality and Social Psychology, 64*, 104-112.
- Rimmer, J. M., Weston, M. A. & Maguire, G.S. (2013). Perceptions of effectiveness and preferences for design and position of signage on Victorian beaches for the management of Hooded Plovers *Thinornis rubricollis*. *The Victorian Naturalist, 130*, (2), 75-80.
- Roese, N. J., & Olson, J. M. (2007). Better, Stronger, Faster Self-Serving Judgment, Affect Regulation, and the Optimal Vigilance Hypothesis. *Perspectives on Psychological Science, 2*(2), 124–141. Retrieved from <https://journals-sagepub-com.ezproxy.library.dal.ca/doi/pdf/10.1111/j.1745-6916.2007.00033.x>
- Rofes, E. (2002). Desires as defiance: gay male sexual subjectivities and resistance to sexual health promotion. *Health Educ. J., 61*, 125–137.
- Rosenberg, M. (1979). *Conceiving the self*. New York: Basic Books, 1993.
- Snow, D. (2001). Coming home: an introduction to collaborative conservation. In: Brick, P., Snow, D., De Wetering, S.V. (Eds.), *Across the Great Divide: Explorations in Collaborative Conservation and the American West*. Washington DC: Island Press.

- Sproesser, G., Klusmann, V., Schupp, H. T., Renner, B. (2017). Self-Other Differences in Perceiving Why People Eat What They Eat. *Frontiers in Psychology*, 8(109), 1–10. <https://doi.org/10.3389/fpsyg.2017.00209>
- Stern, M. J. (2018). Social science theory for environmental sustainability: A practical guide. Oxford University Press.
- Sturgis, N., & Allum, P. (2004). Science in society: Re-evaluating the deficit model of public attitudes. *Public Understanding of Science*, 13, 55–74.
- Suffolk Coast & Heaths. (2012). *A simple method for assessing the risk of disturbance to birds at coastal sites*. Retrieved from: <http://www.suffolkcoastandheaths.org/assets/Projects--Partnerships/DEP/ELAC-report/Report-and-Appendices/App-3-A-simple-method-for-assessing-the-risk-of-disturbance-to-birds-at-coastal-sites.pdf>.
- Sussman, R., & Gifford, R. (2012). Please turn off the lights: The effectiveness of visual prompts. *Applied Ergonomics*, 43, 596–603. <https://doi.org/10.1016/j.apergo.2011.09.008>
- Wallace, K. J., Wagner, C., & Smith, M. J. (2016). Eliciting human values for conservation planning and decisions: A global issue. *Journal of Environmental Management*, 170, 160–168. <https://doi.org/10.1016/j.jenvman.2015.12.036>
- Wilcox, S., & King, A. C. (2000). Self-favoring bias for physical activity in middle-aged and older adults. *Journal of Applied Social Psychology*, 30(9), 1773–1789. <https://doi.org/10.1111/j.1559-1816.2000.tb02467.x>

Wyborn, C., & Bixler, R. P. (2013). Collaboration and nested environmental governance: Scale dependency, scale framing, and cross-scale interactions in collaborative conservation.

*Journal of Environmental Management*, 123, 58–67.

<https://doi.org/10.1016/j.jenvman.2013.03.014>

Yasué, M. (2005). The effects of human presence, flock size and prey density on shorebird foraging rates. *Journal of Ethology*, 23, 199–204.

Ziman, J. (1991). Public Understanding of Science. *Science, Technology, & Human Values* 16 (1), 99-105.

## **APPENDIX A: Verbal Survey Scripts**

Verbal survey scripts to inform the development, piloting and evaluation of conservation strategies that address human-caused threats at key roost sites during peak migration in 2016 and 2017. The 2017 script was edited to include the question “Have you done anything differently this year than in years past”

### **Survey Script/Sheet 2016**

Survey sheet will include the following, but respondents will not be asked anything that is likely easy to capture from simple observation:

**Site name:**

**Date & Time:**

**Tidal state:**

**Consented to survey:**

**Are there witnesses to survey:**

Tracked through observation only:

How many people in the group?

# Adults

# Children

Any dogs with you:

# on leash

# off leash

Do you live nearby? How far did you drive to reach here?

What brought you here today?

Have you come here before?

If so, why do you like this beach?

Do you typically come at high tide? If so, why?

Have you noticed shorebirds in the area when you're here?

If so, how do they react to you?



Do you see them reacting to other users?

This spot is one that migrating shorebirds choose year after year on the Bay of Fundy for resting when their mudflat feeding area is covered by water at high tide. It is critical to their survival, and to bird populations globally.

Did you know about this?

Do you think they are threatened here?

(If yes) What do you think we should do about it? Any ideas?

Do you have any other comments or questions about the project?

Would you be interested in learning more about the project, or getting involved as a volunteer? If so, what is your name and email address? (Write on separate sheet)

## **Survey Script/Sheet 2017**

Site name:

Date & Time:

Tidal state:

Consented to survey:

Are there witnesses to survey:

Tracked through observation only:

How many people in the group?

# Adults

# Children

Any dogs with you

# on leash

# off leash

Do you live nearby? How far did you drive to reach here?

What brought you here today?

Have you come here before?

If so, why do you like this beach?

Do you typically come at high tide? If so, why?

Have you done anything differently this year than in years past?

Have you noticed shorebirds in the area when you're here?

If so, how do they react to you?

Do you see them reacting to other users?

This spot is one that migrating shorebirds choose year after year on the Bay of Fundy for resting when their mudflat feeding area is covered by water at high tide. It is critical to their survival, and to bird populations globally.

Did you know about this?

Do you think they are threatened here?

(If yes) What do you think we should do about it? Any ideas?

Do you have any other comments or questions about the project?

Would you be interested in learning more about the project, or getting involved as a volunteer? If so, what is your name and email address? (Write on separate sheet)

## Survey Script/Sheet 2018

Site:

Date & Time:

Tidal state:

Hi, I'm surveying shorebirds, and I'm wondering if you've noticed them in the area?

This spot is one that migrating shorebirds choose year after year on the Bay of Fundy for resting when their mudflat feeding area is covered by water at high tide. It is critical to their survival, and to bird populations globally.

Did you know about this?

If yes, how did you know? Did you see our signs (point to/describe signs) These handouts (show handout)

If you didn't know about the importance of this site to shorebirds, did you notice our signs & handouts?

## **APPENDIX B: Online Angler Survey, Advertisement, Feedback, Results and Thank-You Letter**

1) Online survey of striped-bass anglers distributed via recreational fishing Facebook groups in Nova Scotia, May 2017.



BIRD STUDIES  
ÉTUDES D'OISEAUX CANADA



DALHOUSIE  
UNIVERSITY

We are looking for ideas from anglers' on how to share the beach with shorebirds at the Guzzle in August, from two hours before to two hours after peak high tide. Thank you for taking 10-15 minutes to fill out this survey.

***Be one of the first 30 people to complete the survey with your name, mailing address and email (or phone number), and we'll send you a \$5 gift card from Tim Hortons! \*Please complete the survey by Friday July 7, 2017\****

Have you noticed thousands of sandpipers at the Guzzle in late summer? The Guzzle is one of the most important resting sites in the Bay of Fundy for Semipalmated Sandpipers during their 4,000km migration south.

**Semipalmated Sandpipers are in trouble - their population in the Bay of Fundy has declined by 50% since 1976, and they need our help.**

**We want to identify safe spaces for resting shorebirds at the Guzzle during peak shorebird migration in August, and we need your help to come up with smart solutions**  
The Space to Roost Project is a partnership of Bird Studies Canada, Dalhousie University, NS Natural Resources, Blomidon Naturalist's Society and the Canadian Wildlife Service. The project aims to work together with recreational beach users to make safe spaces for hundreds of thousands of Semipalmated Sandpipers and other shorebirds.

### **How do we know there is a problem?**

Based on interviews with recreational beach users (walkers, anglers, birders and photographers), and observations made from July-September 2016 at the Guzzle, we noted 48 disturbances of shorebirds by recreational beach users. A disturbance was when one or more shorebirds ran or flew away from one or more recreational users. During 10 high-tide site visits, we found that people walking on the beach disturbed the birds most often (24 times), next was anglers (14 times), photographers (6 times), bird-watchers (3 times) and dog walkers (1 time). We also observed a bird hitting a fishing line, and several anglers reported shorebirds hitting their fishing lines.

### **Why is safe resting space critical to shorebird survival?**

Semipalmated Sandpipers and other shorebirds migrate from the Arctic to South America in August, and stop in the Bay of Fundy to eat twice their body weight and rest. At high tide, when water covers their feeding area, they look for coastal beaches to rest on, like the Guzzle. If they can't find a safe beach to land on, they fly around and waste vital energy reserves. Too much flying and not enough rest puts them in danger of running out of fuel during their epic, three-day over-ocean flight to South America. Despite being shorebirds, they do not swim and so must fly non-stop the entire way.

### **Why is the Guzzle so important?**

The Guzzle offers wide, flat beaches on which shorebirds can rest during high tide and watch for predators, especially falcons. In addition, the site is close to important feeding habitat (they eat tiny worms, crustaceans and biofilm found in the mud flats).

### **How can anglers help?**

We need ideas from anglers' on how to share the beach with shorebirds in August, from two hours before to two hours after peak high tide. While we are primarily concerned with the Guzzle, if you fish elsewhere your ideas are still welcome.

***\*Please complete the survey by Friday July 7, 2017\****

***\*\*After completing the survey, participants may withdraw their survey responses from the project by emailing Jaya at [SpaceToRoost@BirdsCanada.org](mailto:SpaceToRoost@BirdsCanada.org) prior to July 16, 2017\*\****

1. Do you fish for Striped Bass at the Guzzle?

a. Yes

b. No

If not, where do you fish for Striped Bass?

2. Garbage: Shorebirds can get tangled up in discarded fishing line and plastics. Do you have any ideas for how to keep the Guzzle and similar areas free of garbage?

3. Interaction with shorebirds: People walking toward shorebirds causes them to run or fly away, depleting vital energy reserves needed for their 4,000km migration to South America.

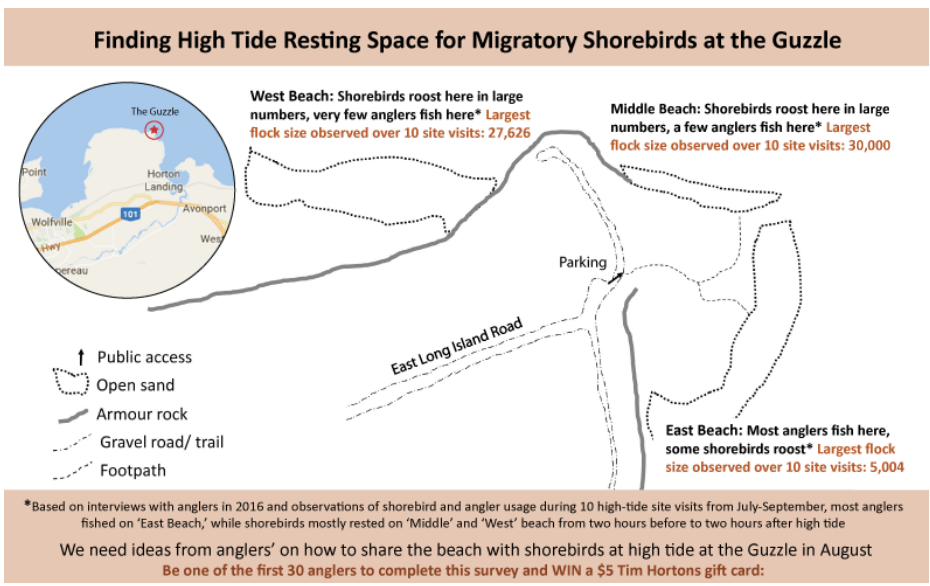
How can we encourage walkers, anglers, photographers, birders, and other beach users to keep away from resting shorebirds and prevent children and dogs from chasing them at high tide?

4. Fishing line: We observed a bird hitting a fishing line, and several anglers reported that shorebirds hit the lines fairly regularly, and sometimes fall into the water before flying away.

Do you have any suggestions for how we can prevent shorebirds from hitting fishing lines?

5. Fishing location: Based on observations at the Guzzle during 10 high-tide site visits from July-September 2016, we found that most anglers fished on ‘East Beach,’ while shorebirds mostly rested on ‘Middle’ and ‘West’ beach from two hours before to two hours after high tide (see below map for beach locations). As a trial to see if shorebird disturbances decrease from 2016 to 2017, which do you think would be the better solution to balance angler and shorebird needs:

- a. Fish only on ‘East’ and ‘Middle’ beaches in August from two hours before to two hours after high tide, and leave ‘West’ beach for the shorebirds (refer to map for beach locations)
- b. Fish only on ‘East’ beach in August from two hours before to two hours after high tide and leave ‘West’ and ‘Middle’ beach for the shorebirds (refer to map for beach locations)
- c. Make no change. Fish on all three beaches; ‘East’ ‘Middle’ and ‘West’ in August from two hours before to two hours after high tide (refer to map for beach locations)



6. Do you foresee problems with asking anglers to fish only on either 'East' beach or 'East' and 'Middle' beaches as a trial in August 2017 from two hours before to two hours after high tide?
7. If we were to trial setting aside one or two beaches at the Guzzle just for shorebirds from two hours before to two hours after high tide in August 2017, how could we communicate this trial change to walkers, anglers, photographers, birders and other users?
8. Are there any other ideas you have for how to share the beaches at the Guzzle with shorebirds?
9. Thank you for your valuable feedback!

If you have any questions, comments or concerns please email Jaya Fahey at [SpaceToRoost@BirdsCanada.org](mailto:SpaceToRoost@BirdsCanada.org) or find me on [Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost)

We will be sending a summary of our results to the NS Striped Bass Association for circulation to all members, or you can visit our Facebook page or contact us directly.

As a thank you for taking the time to complete this survey, please enter your name, mailing address and email (or phone number) and if you are one of the first 30 anglers to complete the survey, we will send you a \$5 Tim Hortons gift card!

Please tick here if we can use your contact information (below) to send you information like research summaries or with opportunities to collaborate.

Please enter your name, address and email (or phone number) here:



## 2) Advertisement for the online angler survey targeted to angler groups on Facebook. Design Credit Fahey, J. 2016

### Finding High Tide Resting Space for Migratory Shorebirds at the Guzzle



*Semipalmated Sandpipers are in trouble—their population in the Bay of Fundy has declined by 50% since 1976, and they need our help*

We are looking for ideas from anglers' on how to share the beach with shorebirds at the Guzzle in August, from two hours before to two hours after peak high tide. Thank you for taking a few minutes to fill out this online survey: [SURVEY LINK](#)

Have you noticed thousands of sandpipers at the Guzzle in late summer? The Guzzle is one of the most important resting sites in the Bay of Fundy for Semipalmated Sandpipers during their 4,000km migration south.

#### **We want to identify safe spaces for resting shorebirds at the Guzzle during peak shorebird migration in August, and we need your help to come up with smart solutions**

The Space to Roost Project is a partnership of Bird Studies Canada, Dalhousie University, NS Natural Resources, Blomidon Naturalist's Society and the Canadian Wildlife Service. The project aims to work together with recreational beach users to make safe spaces for hundreds of thousands of Semipalmated Sandpipers and other shorebirds.

#### **How do we know there is a problem?**

Based on interviews with recreational beach users (walkers, anglers, birders and photographers), and observations made from July-September 2016 at the Guzzle, we noted 48 disturbances of shorebirds by recreational beach users. A disturbance was when one or more shorebirds ran or flew away from one or more recreational users. During 10 high-tide site visits, we found that people walking on the beach disturbed the birds most often (24 times), next was anglers (14 times), photographers (6 times), bird-watchers (3 times) and a dog walker (one time). We also observed a bird hitting a fishing line, and several anglers reported shorebirds hitting their fishing lines.

#### **Why is safe resting space critical to shorebird survival?**

Semipalmated Sandpipers and other shorebirds migrate from the Arctic to South America in August, and stop in the Bay of Fundy to eat twice their body weight and rest. At high tide, when water covers their feeding area, they look for coastal beaches to rest on, like the Guzzle. If they can't find a safe beach to land on, they fly around and waste vital energy reserves. Too much flying and not enough rest puts them in danger of running out of fuel during their epic, three-day over-ocean flight to South America. Despite being shorebirds, they do not swim and so must fly non-stop the entire way.

#### **Why is the Guzzle so important?**

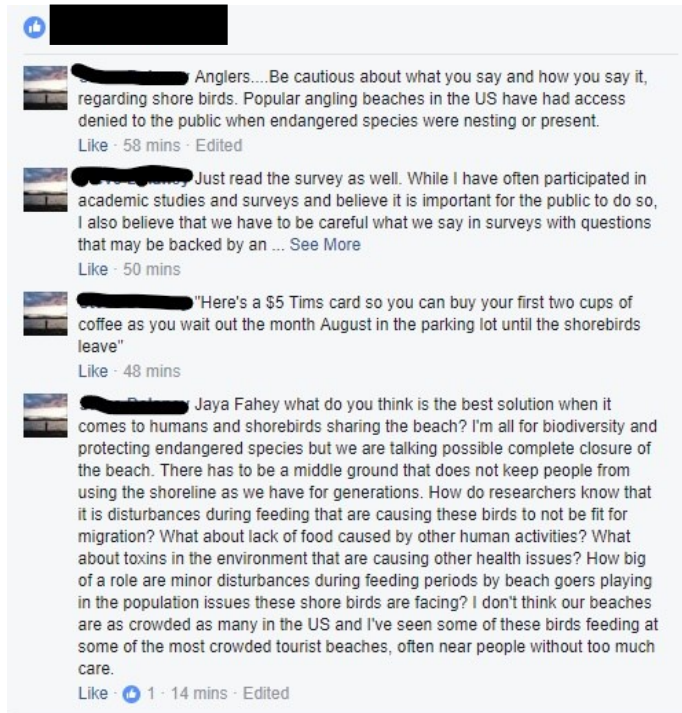
The Guzzle offers wide, flat beaches on which shorebirds can rest during high tide and watch for predators, especially falcons. In addition, the site is close to important feeding habitat (they eat tiny worms, crustaceans and biofilm found in the mud flats).

#### **How can anglers help?**

We need ideas from anglers' on how to share the beach with shorebirds at the Guzzle in August, from two hours before to two hours after peak high tide. Please take a few minutes to fill out the survey here: [survey link](#)

*Be one of the first 30 people to complete the survey with your name, mailing address and email (or phone), and we'll send you a \$5 gift card from Tim Hortons!*

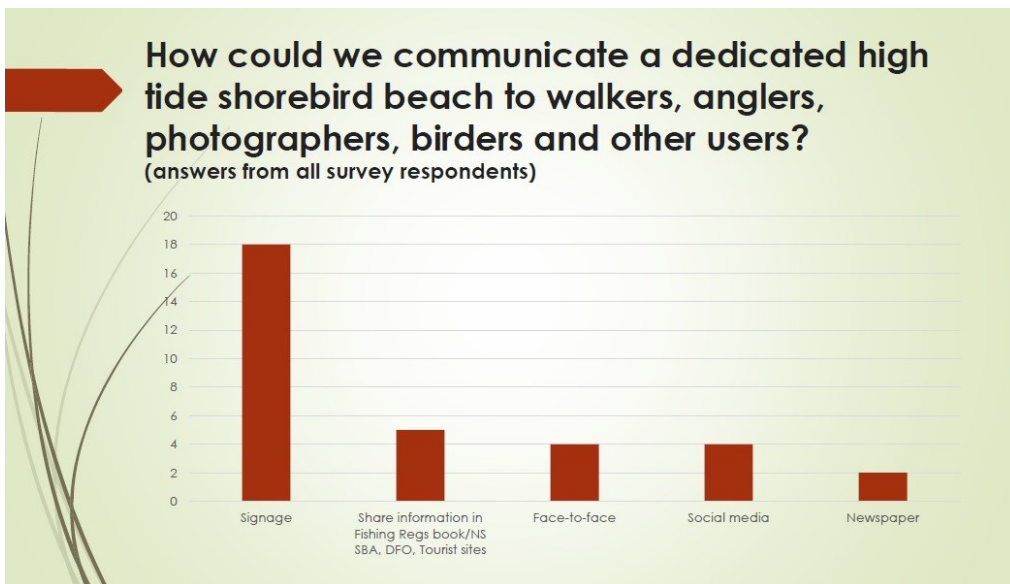
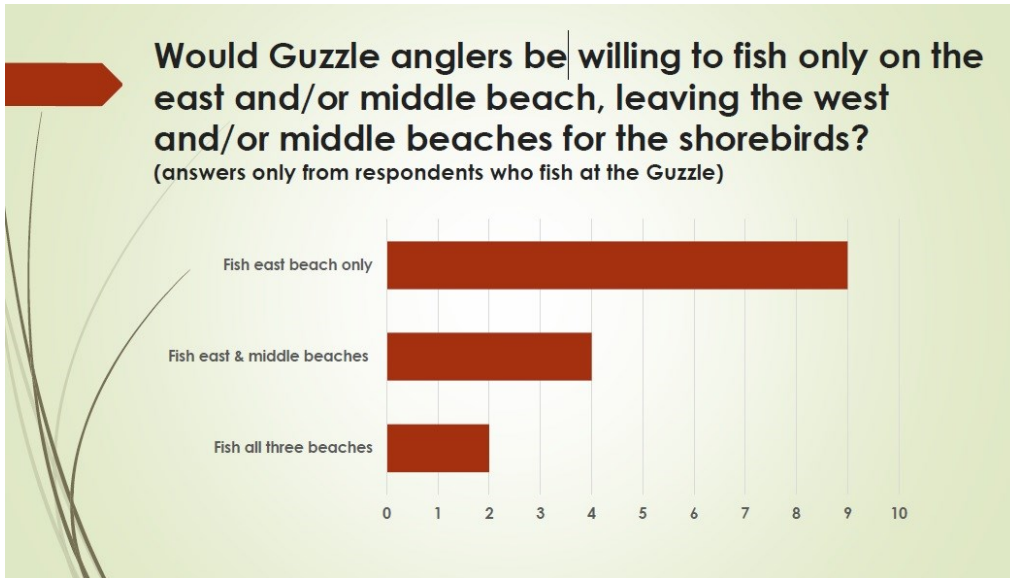
### 3) Feedback from one angler on Facebook dissuading other anglers from answering questions (Names removed for privacy). Credit: Facebook.com/Spacetroost



A screenshot of a Facebook post with four comments. The post is from a user whose name is redacted with a black box. The comments are:

- Comment 1:** "Anglers...Be cautious about what you say and how you say it, regarding shore birds. Popular angling beaches in the US have had access denied to the public when endangered species were nesting or present." (58 mins, Edited)
- Comment 2:** "Just read the survey as well. While I have often participated in academic studies and surveys and believe it is important for the public to do so, I also believe that we have to be careful what we say in surveys with questions that may be backed by an ... See More" (50 mins)
- Comment 3:** "'Here's a \$5 Tims card so you can buy your first two cups of coffee as you wait out the month August in the parking lot until the shorebirds leave'" (48 mins)
- Comment 4:** "Jaya Fahey what do you think is the best solution when it comes to humans and shorebirds sharing the beach? I'm all for biodiversity and protecting endangered species but we are talking possible complete closure of the beach. There has to be a middle ground that does not keep people from using the shoreline as we have for generations. How do researchers know that it is disturbances during feeding that are causing these birds to not be fit for migration? What about lack of food caused by other human activities? What about toxins in the environment that are causing other health issues? How big of a role are minor disturbances during feeding periods by beach goers playing in the population issues these shore birds are facing? I don't think our beaches are as crowded as many in the US and I've seen some of these birds feeding at some of the most crowded tourist beaches, often near people without too much care." (14 mins, Edited)

4) Results of the angler survey posted to angler Facebook groups and our Space to Roost Facebook page. Design Credit Fahey, J. 2016



5) Thank-you letter sent to each of the angler survey respondents with a \$5 Tim Hortons coffee card (Name removed for privacy).



June 29, 2017

Dear [REDACTED]

Thank you for taking the time to fill out the *Space to Roost* survey. Enjoy your next visit to Tim Hortons on us!

The results of the survey and all future project updates will be posted to our Facebook page ([Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost)) after July 17, 2017. Please 'like' and share our page with your friends!

I am very happy to speak with you about your survey responses and answer any questions you may have about the project. Please email me at [SpaceToRoost@BirdsCanada.org](mailto:SpaceToRoost@BirdsCanada.org) and we can talk via email or set up a time to chat by phone.

Thank you for your interest in *Space to Roost*, and I look forward to seeing you on the beach this summer!

Sincerely,

Jaya Fahey

Shorebird Stewardship Biologist  
Bird Studies Canada  
MES Candidate  
School for Resource and Environmental Studies  
Dalhousie University

[www.facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost)  
[www.birdscanada.org](http://www.birdscanada.org)

## APPENDIX C: Handouts

Handouts detailing ‘how to help’ messaging for high tide roost sites, project information and a tide chart on the back (to motivate users to refer to it throughout the summer). Design Credit Fahey, J. 2016



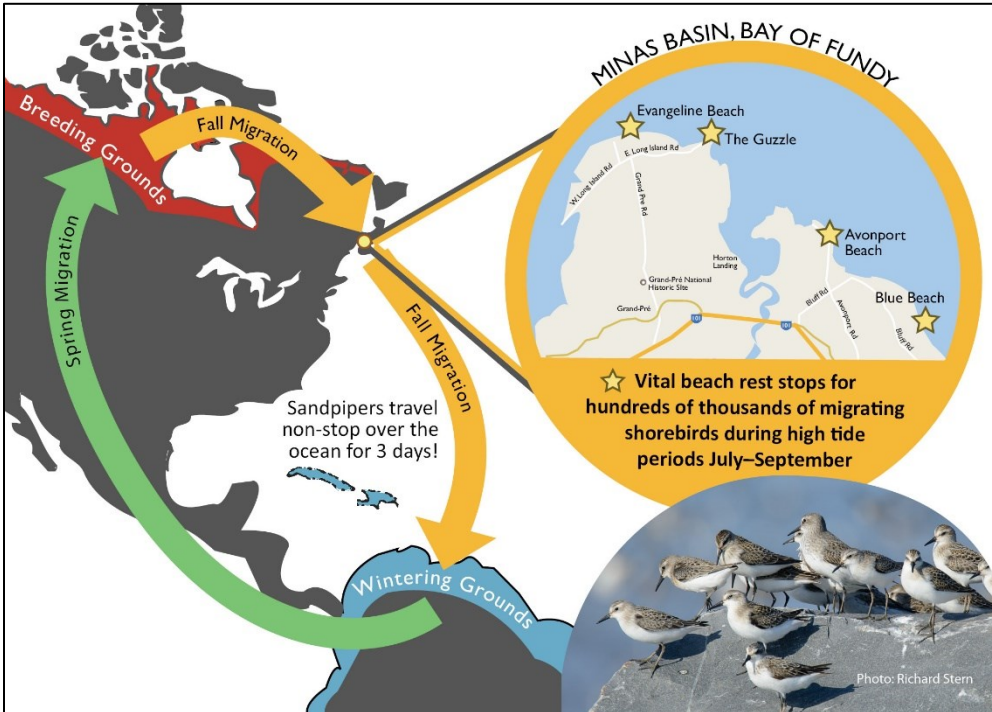
Our population has **dropped by half** since 1976. Please give us space to rest on Bay of Fundy beaches!

Photo: Jaya Fahey

**How to share beaches with shorebirds in the Minas Basin, Bay of Fundy**  
Mid July–Mid September 2017



**Project funded by:** • Blomidon Naturalists Society • The Government of Canada's Habitat Stewardship Program • IBA Local Action Fund



**MINAS BASIN, BAY OF FUNDY**

Evangeline Beach  
The Guzzle  
Avonport Beach  
Blue Beach

Wulong Island Rd  
E. Long Island Rd  
Grand-Pré Rd  
Harrison Landing  
Grand-Pré  
Bluff Rd  
Avonport Rd  
Bluff Rd

☆ **Vital beach rest stops for hundreds of thousands of migrating shorebirds during high tide periods July–September**

Spring Migration

Fall Migration

Wintering Grounds

Breeding Grounds

Sandpipers travel non-stop over the ocean for 3 days!

Photo: Richard Stern

## Help shorebirds continue their migration

*Shorebirds can't swim, so they must be well-rested and well-fed to fly 4,000 km non-stop over the ocean to their wintering grounds in South America!*

### What months are shorebirds present?

- Mid July–mid September (highest numbers in August)

### When is shorebird resting time?

- 2 hours before to 2 hours after high tide (refer to tide chart on back side)

### Please help shorebirds rest safely

- Use binoculars for a closer look

### How do I avoid disturbing flocks?

- Use established trails, stay as far away from shorebird flocks as possible
- Walk slowly when shorebirds are present
- Take photos with a telephoto lens
- If shorebirds seem restless, move away
- Explain to children why birds need rest
- Keep dogs on leash
- Pack out food & trash

Follow the Space to Roost project on Facebook for great photos and videos of these amazing shorebirds!

 [Facebook.com/SpacetoRoost](https://www.facebook.com/SpacetoRoost)



Least Sandpiper



Semipalmated Plover



Semipalmated Sandpiper

Photos: Richard Stern, Louis Rainys

## Avoid disturbing flocks during shorebird resting times

**Within 2 hours of high tide during peak migration (August 2017), Minas Basin**

August 1	06:43 – 10:43 19:08 – 23:08	August 11	01:55 – 05:55 14:19 – 18:19	August 21	00:00 – 02:43 11:12 – 15:12 23:35 – 24:00
August 2	07:36 – 11:36 20:00 – 24:00	August 12	02:40 – 06:40 15:04 – 19:04	August 22	00:00 – 03:35 12:02 – 16:02
August 3	08:28 – 12:28 20:50 – 24:00	August 13	03:27 – 07:27 15:53 – 19:53	August 23	00:25 – 04:25 12:50 – 16:50
August 4	00:00 – 00:50 09:17 – 13:17 21:38 – 24:00	August 14	04:19 – 08:19 16:45 – 20:45	August 24	01:13 – 05:13 13:37 – 17:37
August 5	00:00 – 01:38 10:04 – 14:04 22:24 – 24:00	August 15	05:15 – 09:15 17:43 – 21:43	August 25	01:59 – 05:59 14:23 – 18:23
August 6	00:00 – 02:24 10:49 – 14:49 23:08 – 24:00	August 16	06:15 – 10:15 18:44 – 22:44	August 26	02:45 – 06:45 15:08 – 19:08
August 7	00:00 – 03:08 11:31 – 15:31 23:50 – 24:00	August 17	07:17 – 11:17 19:47 – 23:47	August 27	03:31 – 07:31 15:54 – 19:54
August 8	00:00 – 03:50 12:13 – 16:13	August 18	08:20 – 12:20 20:48 – 24:00	August 28	04:19 – 08:19 16:42 – 20:42
August 9	00:31 – 04:31 12:54 – 16:54	August 19	00:00 – 00:48 09:21 – 13:21 21:48 – 24:00	August 29	05:08 – 09:08 17:33 – 21:33
August 10	01:13 – 05:13 13:36 – 17:36	August 20	00:00 – 01:48 10:18 – 14:18 22:43 – 24:00	August 30	06:00 – 10:00 18:26 – 22:26
				August 31	06:55 – 10:55 19:21 – 23:21

## APPENDIX D: Signage and Tide Chart

Seasonal on-site (1, 3) anchored and (2, 4) sandwich-board signage identifying The Guzzle as vital shorebird roosting habitat, asking users to avoid the beach from two hours before and after high tide in August. (5) High tide chart affixed to signage. Design Credit Fahey, J. 2016

1)



2)

**ATTENTION**

At high tide, this beach is reserved for resting shorebirds  
 À marée haute, cette plage est réservée aux oiseaux de rivage au repos

You can help shorebirds by staying on the trail at high tide  
 2 hours before and after high tide during peak migration in August (see tide chart below)

Pour aider les oiseaux de rivage, restez sur la piste à marée haute  
 De 2 heures avant à 2 heures après la marée haute au plus fort de la migration, en août (consultez la table des marées ci-dessous)

**Avoid disturbing Rocks during shorebird resting times**  
 Évitez de déranger les rochers pendant leurs périodes de repos

Date	High Tide	High Tide	High Tide	High Tide
August 1st	06:00-06:30	12:00-12:30	18:00-18:30	24:00-24:30
August 2nd	06:15-06:45	12:15-12:45	18:15-18:45	24:15-24:45
August 3rd	06:30-07:00	12:30-13:00	18:30-19:00	24:30-25:00
August 4th	06:45-07:15	12:45-13:15	18:45-19:15	24:45-25:15
August 5th	07:00-07:30	13:00-13:30	19:00-19:30	25:00-25:30
August 6th	07:15-07:45	13:15-13:45	19:15-19:45	25:15-25:45
August 7th	07:30-08:00	13:30-14:00	19:30-20:00	25:30-26:00
August 8th	07:45-08:15	13:45-14:15	19:45-20:15	25:45-26:15
August 9th	08:00-08:30	14:00-14:30	20:00-20:30	26:00-26:30
August 10th	08:15-08:45	14:15-14:45	20:15-20:45	26:15-26:45
August 11th	08:30-09:00	14:30-15:00	20:30-21:00	26:30-27:00
August 12th	08:45-09:15	14:45-15:15	20:45-21:15	26:45-27:15
August 13th	09:00-09:30	15:00-15:30	21:00-21:30	27:00-27:30
August 14th	09:15-09:45	15:15-15:45	21:15-21:45	27:15-27:45
August 15th	09:30-10:00	15:30-16:00	21:30-22:00	27:30-28:00
August 16th	09:45-10:15	15:45-16:15	21:45-22:15	27:45-28:15
August 17th	10:00-10:30	16:00-16:30	22:00-22:30	28:00-28:30
August 18th	10:15-10:45	16:15-16:45	22:15-22:45	28:15-28:45
August 19th	10:30-11:00	16:30-17:00	22:30-23:00	28:30-29:00
August 20th	10:45-11:15	16:45-17:15	22:45-23:15	28:45-29:15
August 21st	11:00-11:30	17:00-17:30	23:00-23:30	29:00-29:30
August 22nd	11:15-11:45	17:15-17:45	23:15-23:45	29:15-29:45
August 23rd	11:30-12:00	17:30-18:00	23:30-24:00	29:30-30:00
August 24th	11:45-12:15	17:45-18:15	23:45-24:15	29:45-30:15
August 25th	12:00-12:30	18:00-18:30	24:00-24:30	30:00-30:30
August 26th	12:15-12:45	18:15-18:45	24:15-24:45	30:15-30:45
August 27th	12:30-13:00	18:30-19:00	24:30-25:00	30:30-31:00
August 28th	12:45-13:15	18:45-19:15	24:45-25:15	30:45-31:15
August 29th	13:00-13:30	19:00-19:30	25:00-25:30	31:00-31:30
August 30th	13:15-13:45	19:15-19:45	25:15-25:45	31:15-31:45
August 31st	13:30-14:00	19:30-20:00	25:30-26:00	31:30-32:00

Map labels: Minas Basin, BASSIN DES MINES, Shorebird resting beach, Plage de repos des oiseaux de rivage, Middle beach, Plage du milieu, East beach, Plage de l'est, Doherty Digue, Chemin East Long Island Rd.

Logos: Environment Canada, Parks Canada, New Brunswick, Environment and Climate Change Canada, Project funded by: 1001 Local Action Fund - Nouveau Brunswick, The Government of Canada's Habitat Stewardship Program, Gouvernement du Nouveau Brunswick, Programme de Stewardship des Habitats.



3)

# ATTENTION

**This coastal area is a vital rest stop for migrating shorebirds in the summer**

**You can help by sharing this area with shorebirds during resting times**

**When is shorebird resting time?**  
 Mid–July to Mid–September (highest numbers in August)  
 Two hours before to two hours after peak high tide (see tide chart below)

**How do I avoid disturbing shorebirds during resting times?**

- Avoid the "Shorebird Resting Beach" (see red area on map below)
- Stay as far away from flocks as possible
- Walk slowly when shorebirds are present
- Take photos with a telephoto lens
- Keep dogs on leash
- Please take a handout to learn more

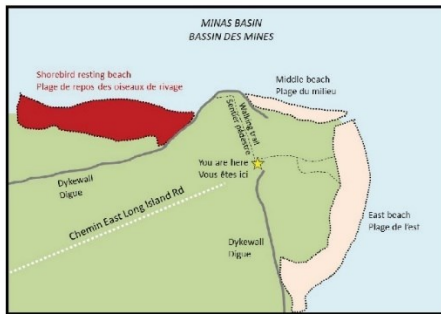
**Cette zone est une aire de repos essentielle l'été pour les oiseaux de rivage en migration**

**Vous pouvez aider en partageant cette zone avec les oiseaux de rivage au repos**

**Quand se reposent-ils?**  
 De la mi-juillet à la mi-septembre (population maximale en août)  
 Période comprise entre 2 heures avant et 2 heures après la marée haute (voir la table des marées ci-dessous)

**Comment éviter de déranger les oiseaux de rivage au repos?**

- Évitez la «plage de repos des oiseaux de rivage» (voyez la carte ci-dessous)
- Tenez-vous le plus loin possible des oiseaux
- Marchez lentement à proximité des oiseaux
- Prenez des photos de loin avec un téléobjectif
- Gardez les chiens en laisse
- Pour en savoir plus, prenez un dépliant



We are grateful to local anglers and recreational users who provided ideas on how to share space with shorebirds in the Minas Basin, Bay of Fundy.

The Space to Roost project is led by Bird Studies Canada and Dalhousie University with support from partners: Environment & Climate Change Canada, NS Natural Resources, Blomidon Naturalists Society, and Nature Conservancy of Canada

We welcome your feedback and questions: [SpaceToRoost@BirdsCanada.org](mailto:SpaceToRoost@BirdsCanada.org) or [Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost)

**Avoid disturbing flocks during shorebird resting times**  
 Within 2 hours of high tide during peak migration (August), Minas Basin

**Évitez de déranger les oiseaux pendant leurs périodes de repos**  
 Dans les 2 heures précédant et suivant la marée haute au plus fort de la migration (août), bassin des Mines

Nous remercions les pêcheurs sportifs et les utilisateurs des plages de la région qui ont suggéré des moyens de partager l'espace avec les oiseaux de rivage dans le bassin des Mines de la baie de Fundy.

Le projet Espaces de repos est mené par Études d'Oiseaux Canada et l'Université Dalhousie avec le soutien d'Environnement et Changement climatique Canada et Conservation, du ministère des Ressources naturelles de la Nouvelle-Écosse, de la Blomidon Naturalists Society, et de la Conservation de la nature Canada.

Vos commentaires et questions sont les bienvenus : [SpaceToRoost@OiseauxCanada.org](mailto:SpaceToRoost@OiseauxCanada.org) ou [Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost)

4)



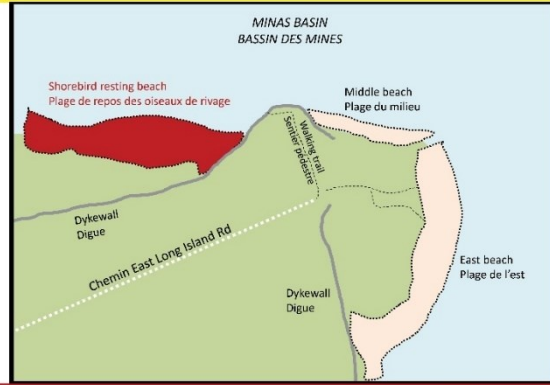
**You can help shorebirds by staying on the trail at high tide**

2 hours before and after high tide during peak migration in August  
(see tide chart below)

**Pour aider les oiseaux de rivage, restez sur la piste à marée haute**

De 2 heures avant à 2 heures après la marée haute au plus fort de la migration, en août (consultez la table des marées ci-dessous)

**Avoid disturbing flocks during shorebird resting times**  
Within 2 hours of high tide during peak migration (August), Minas Basin  
**Évitez de déranger les oiseaux pendant leurs périodes de repos**  
Dans les 2 heures précédant et suivant la marée haute au plus fort de la migration (août), bassin des Mines



DALHOUSIE UNIVERSITY



Environment and Climate Change Canada

Environnement et Changement climatique Canada

NOVA SCOTIA  
NOUVELLE-ÉCOSSE



NATURE BC  
NATURE C.A.B.A.

Project funded by: The Government of Canada, Habitat Stewardship Program, Commission for Environmental Cooperation, IBA Local Action Fund, Nova Scotia Habitat Conservation Fund, Contributions from Hurblers and Trappers, NS Natural Resources, Blomidon Naturalists Society  
Commanditaires: gouvernement du Canada (Programme d'intendance de l'habitat), Commission de coopération environnementale, Fonds d'action local dans les ZICO, Contributions des chasseurs et des trappeurs au Fonds de conservation de l'habitat de la Nouvelle-Écosse, ministère des Ressources naturelles de la Nouvelle-Écosse, Blomidon Naturalists Society

5) High Tide Chart affixed to signage. Design Credit Fahey, J. 2016

August 1 août 06:43 – 10:43 19:08 – 23:08	August 9 août 00:31 – 04:31 12:54 – 16:54	August 17 août 07:17 – 11:17 19:47 – 23:47	August 25 août 01:59 – 05:59 14:23 – 18:23
August 2 août 07:36 – 11:36 20:00 – 24:00	August 10 août 01:13 – 05:13 13:36 – 17:36	August 18 août 08:20 – 12:20 20:48 – 24:00	August 26 août 02:45 – 06:45 15:08 – 19:08
August 3 août 08:28 – 12:28 20:50 – 24:00	August 11 août 01:55 – 05:55 14:19 – 18:19	August 19 août 00:00 – 00:48 09:21 – 13:21 21:48 – 24:00	August 27 août 03:31 – 07:31 15:54 – 19:54
August 4 août 00:00 – 00:50 09:17 – 13:17 21:38 – 24:00	August 12 août 02:40 – 06:40 15:04 – 19:04	August 20 août 00:00 – 01:48 10:18 – 14:18 22:43 – 24:00	August 28 août 04:19 – 08:19 16:42 – 20:42
August 5 août 00:00 – 01:38 10:04 – 14:04 22:24 – 24:00	August 13 août 03:27 – 07:27 15:53 – 19:53	August 21 août 00:00 – 02:43 11:12 – 15:12 23:35 – 24:00	August 29 août 05:08 – 09:08 17:33 – 21:33
August 6 août 00:00 – 02:24 10:49 – 14:49 23:08 – 24:00	August 14 août 04:19 – 08:19 16:45 – 20:45	August 22 août 00:00 – 03:35 12:02 – 16:02	August 30 août 06:00 – 10:00 18:26 – 22:26
August 7 août 00:00 – 03:08 11:31 – 15:31 23:50 – 24:00	August 15 août 05:15 – 09:15 17:43 – 21:43	August 23 août 00:25 – 04:25 12:50 – 16:50	August 31 août 06:55 – 10:55 19:21 – 23:21
August 8 août 00:00 – 03:50 12:13 – 16:13	August 16 août 06:15 – 10:15 18:44 – 22:44	August 24 août 01:13 – 05:13 13:37 – 17:37	

6) Existing signage at The Guzzle that was largely ignored by users, as if it had become part of the background. Photo credit: Kate Sherren, 2016.



# APPENDIX E: Datasheets, Blank and Completed, Maps of Usage and Disturbance

1) Site Audit datasheet (2 pages). Credit: Birds Canada, 2016

Observer(s): \_\_\_\_\_ Date: Aug \_\_\_\_\_ 2018 Site: GUZ Start time: \_\_\_\_\_ End time: \_\_\_\_\_  
 Peak high tide time: \_\_\_\_\_ Weather (circle): sun prt1 sun ovrcst fog drizzle TempdegC: \_\_\_\_\_ Wind dir (circle): N NE E SE S SW W NW  
 Beaufort(circle): 0=glassy 1=ripples 2=small waves/leaves rustle 3=some white caps/twigs sway 4=white caps 5=mod waves

Date	Time	Peak +2.0	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak +1.5	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak +1.0	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak +0.5	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak 0	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak -0.5	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak -1.0	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak -1.5	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0
Date	Time	Peak -2.0	#walker	#dogwvkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#photog	#swimr	#bathr	#boatr	#veh	#feed	#roost	#fly	#totpeep
		Sec 1																0
		Sec 2																0
		Sec 3																0

Total estimated # shorebirds observed on or in vicinity of roost site during survey (add together highest number from each section):

**Shorebird disturbance (record all incidents throughout survey)**

Incident#	Time	Section#	dist_type	#dist_type	#birds_dist	bird_behav	notes
Ex: DIST01	13:15	1	BI	2	10	FR	2 birds flushed 10 peeps, flew over water, returned to roost
DIST 01							
DIST 02							
DIST 03							
DIST 04							
DIST 05							
DIST 06							
DIST 07							
DIST 08							
DIST 09							
DIST 10							
DIST 11							
DIST 12							
DIST 13							
DIST 14							
DIST 15							
DIST 16							
DIST 17							
DIST 18							
DIST 19							
DIST 20							
DIST 21							
DIST 22							
DIST 23							
DIST 24							
DIST 25							

dist\_type: Unknown= UK (birds flushed for no apparent reason), Non-Predator= NP (gull/other non-predatory bird flying over, peeps joining flock), Predator= PR, Walker= WA, Fisher= FI, Birder= BI, Photographer= PH, Swimmer= SW, Walker+dog\_offish= WU, Walker+dog\_onish= WL, Dogatlarge= DA, Vehicle= VE, Boat= BO  
 bird\_behav: Move (no flight)= MO, Flush and return to site= FR, Flush and leave site= FL, Alert (Standing up right, neck extended) = AL

Other info (# handouts given out, # of people talked to, # handouts replenished from site box, # ppl reading sign/taking handouts from box, etc)

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## 2) Completed audit (3 pages). Credit : Birds Canada, 2016

Observer(s): Jaya Fahey, Rick Whitman Date(13/08/17): 00/00/00 Site: Guzzle

Start time: 15:53 End time: 19:53 Peak high tide time: 17:53 Peak high tide height (m): 13.76

Weather: partial cloud TempdegC: 24 Wind dir: SW

Beaufort(circle): 1

### Roost Site Spot checks

Peak -2.0	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					13	16							
Section2	11						5				2		
Section3							3				2		PH, BI on armour
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1		30		30							1		
Section2		3,000	500	3,500									
Section3													
Peak -1.5	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					17	23							
Section2	18										13		
Section3													
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1		20		20									
Section2		5,000		5,000									
Section3													
Peak -1.0	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					16	22					2		on armour between sec 1/2
Section2											3		
Section3	1										2		
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1		40	20	60									
Section2													200 gulls in field
Section3													
Peak -0.5	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					16	22							
Section2	7												
Section3													
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1													
Section2			300	300									Fly W to E
Section3		18		18									
Peak 0	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					14	16							
Section2	5												
Section3	4												On path
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1													
Section2													
Section3		15	10	25									
Peak +0.5	#walkr	#dogwlkr	#dog_on	#dog_off	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					13	17							
Section2													

Section3	1						1				1			WA on Shorebird resting beach - walked length, read sign on far end, came back
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes	
Section1		90		90										
Section2														
Section3		12		12										

<b>Peak +1.0</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					9	15							
Section2													
Section3	2						1			1			2 WA reading beach sign
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1													
Section2			200	200									Fly east
Section3			2,000	2,000									Fly west
<b>Peak +1.5</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					9	13							
Section2	3												At dyke interp signs
Section3							1			1			
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1		2	40	42							69		Fly east
Section2		160		160							10		300 Gull sp. In field
Section3		6		6									
<b>Peak +2.0</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#rods	#birdr	#swimr	#bathr	#photog	#boatr	#veh	notes
Section1					9	11							
Section2													
Section3							1			1			
	#feed	#roost	#fly	#totpeep	#SESA	#LESA	#SEPL	#BBPL	#PEFA	#BAEA	#GULL	#_____	notes
Section1		1		1							72		
Section2	100			100				3					
Section3	200			200									

Total estimated # shorebirds observed on or in vicinity of roost site during survey: 11,764

<b>Total # users</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#birdr	#swimr	#bathr	#photog	#boatr	#veh	<b>TOTAL USERS</b>
	52	0	0	0	17	12	0	0	28	0	0	109
<b>Sec 1</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#birdr	#swimr	#bathr	#photog	#boatr	#veh	<b>TOTAL USERS</b>
	0	0	0	0	17	0	0	0	2	0	0	19
<b>Sec 2</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#birdr	#swimr	#bathr	#photog	#boatr	#veh	<b>TOTAL USERS</b>
	28	0	0	0	0	5	0	0	13	0	0	46
<b>Sec 3</b>	#walkr	#dogwlkr	#dog_onl	#dog_offl	#fishr	#birdr	#swimr	#bathr	#photog	#boatr	#veh	<b>TOTAL USERS</b>
	6	0	0	0	0	4	0	0	5	0	0	15



**Shorebird disturbance (record all incidents throughout survey)**

Incident#	Time	Section#	dist_type	#dist_tyg	#birds_dist	bird_behav	notes
DIST 1-6	16:04	2	UK	NA	3,000	FR x 6	
DIST 7	16:20	2	UK	NA	3,000	FR	
DIST 8	16:21	2	UK	NA	1,000	FR	
DIST 9	16:22	2	UK	NA	3,000	FR	
DIST 10	16:23	3	UK	NA	20	FR	
DIST 11-15	16:34	3	UK	NA	18	FR x 5	
DIST 16	16:35	2	UK	NA	5,000	FR	
DIST 17	16:36	2	UK	NA	1,000	FR	
DIST 18	16:37	2	UK	NA	5,000	FR	
DIST 19	16:38	2	UK	NA	1,000	FR	
DIST 20-24	16:39	2	UK	NA	5,000	FR x 5	
DIST 25	16:40	2	PR	1	5,000	FL	PEFA FL 5,000 peep, caught 1
DIST 26	17:16	1	FI	1	1	FL	FI walking toward sec 2
DIST 27	17:23	3	UK	NA	18	FL	18 landed, then FL
DIST 28	18:23	3	WA	1	12	FL	1 WA (teenaged girl) read beach sign, then walked down dyke down armour and walked across beach, flushed 12. Got to second sign, read that, then cut across to armour and walked back along dyke. I talked to her and gave a card. She has a cottage at Eva
DIST 29	18:28	1	UK	NA	60	FL	60 landed, then FL immediately
DIST 30	18:56	3	UK	NA	2,000	FL	Landed, FL
DIST 31	19:23	2	HERG	10	60	FL	HERGs flying over, 60 FL

**dist\_type:** Walker= WA, Fisher= FI, Birder= BI, Swimmer= SW, Walker+unleashdog= WU, Walker+leashdog= WL, Dogatlarge= DA, Vehicle= VE, Kite= KI, Aircraft= AI, Predator= PR, Boat= BO, Clammer= CL  
**bird\_behav:** Move (no flight)= MO, Flush and return to site= FR, Flush and leave site= FL, Alert= AL

**General human use: document and photograph (if possible) once per survey**

Type human use	# obsrvd	notes
New vehicle tracks		
New campfire use		
New firecrackers		

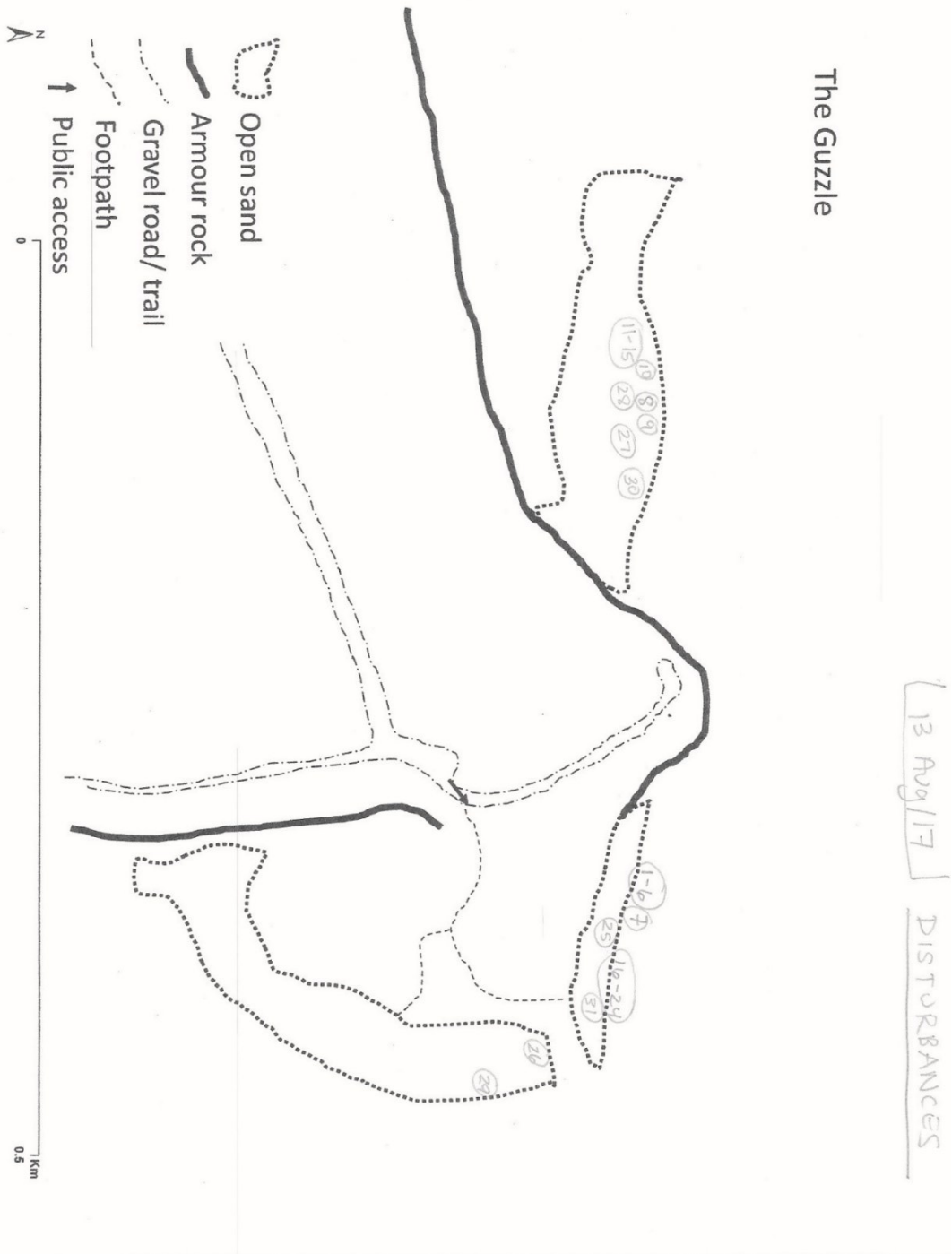
**Additional information (e.g., shorebird behaviour, other species observed, occurrences of interest):**

**Spk to 10 people, Gave 7 cards**

Spoke to Chris from A for Adventure and David Currie from NS Bird Society  
 17:36 - 4 people read beach sign, then 3 went down the armour rock to the water (no beach there at high tide).  
 One went swimming. Spk to them, gave a card. Were quite interested  
 18:57 - 3 people reading sign, spk to them, gave card  
 19:00 spk to girl who had walked on Shorebird Resting beach, gave card. Has cottage at Eva



4) Site Audit Disturbance Map. Credit: Birds Canada, 2016



# APPENDIX F: Engagement: Project Updates, Handout Display, TV Interviews, Shorebird Yoga, and Example of Article in Local Paper/Newsletter

1) Project update to beach goers, posted on site and on Facebook, 2017. Design Credit: Fahey, J. 2017

## Thank you for helping the shorebirds! Dear Guzzle & Avonport Beachgoers:



The Shorebird Resting Beach pilot at The Guzzle and Avonport beach was a great success! Thank you very much for sharing the beach with shorebirds during their stopover in the Minas Basin in late summer.

The Shorebird Resting Beach was a section of beach at each site used by resting shorebirds from 2 hours before and after high tide in August 2017. The majority of beachgoers voluntarily avoided these areas during that time.

### Here's a summary of outcomes from The Guzzle and Avonport in 2017:

- Fewer shorebirds disturbed by people at both Shorebird Resting Beaches in 2017 compared to 2016
- 100% respect of Shorebird Resting Beaches by anglers
- The proportion of people interviewed who knew the importance of the area to shorebirds increased from 47% in 2016 to 78% in 2017
- At the Guzzle, the proportion of beachgoers staying on the dyke above the Shorebird Resting Beach (and not going down to the beach) increased from 2016 to 2017

We're grateful for your help and attention on and off the beach. Please feel free to pass this update on to whomever you think may be interested. Also available for sharing at [Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost).

Contact us with questions or concerns throughout the spring and summer:  
Jaya Fahey – Bird Studies Canada Shorebird Stewardship Biologist & Master of Environmental Studies Candidate 2019, Dalhousie University: [SpaceToRoost@BirdsCanada.org](mailto:SpaceToRoost@BirdsCanada.org)  
Sue Abbott – Bird Studies Canada Atlantic Program Coordinator: [SAbbott@BirdsCanada.org](mailto:SAbbott@BirdsCanada.org)

Thank you for your interest!  
The Space to Roost team



2017 Handouts - look for 2018 handouts in early July



Sign at entrance to the Guzzle with handouts



Shorebird Resting beach sign



2) Handout displays at a local businesses. Photos: Jaya Fahey



3) Interviews with CBC, Global and CTV News for the 30<sup>th</sup> Anniversary of Minas Basin WSHRN Designation. Photos: Birds Canada Twitter, 2018; Richard Stern



4) Sunset Yoga and Shorebird Viewing advertisement. Design Credit Fahey, J. 2016

***FREE Sunset Yoga & Shorebird Viewing***  
**Evangeline beach, Grand Pré**  
**August 18th, 6:30-8:00 pm**



Yoga instructor Carol Fellowes will lead you through a 60 minute all-levels yoga practice. Please bring a yoga mat and water.

As we watch flocks of shorebirds roosting on the beach at sunset, Bird Studies Canada biologist Jaya Fahey will talk about how to observe the birds without disturbing them. Please bring binoculars.



Carol brings her intensive learning of anatomy, biomechanics, restorative exercise and exploring various forms of movement into her yoga practice and teaching – coming together into a beautiful partnership of how the body moves and heals itself. Carol is the creator of FIX YOUR DAMN NECK (online soon!) and Yog-Evolve. She teaches classes, leads retreats, and is a registered massage therapist.

Event sponsored by:



## 5) Article published in local paper *The Grapevine*

### Space to Roost: Helping shorebirds continue their migration

By Jaya Fahey and Sue Abbott, Bird Studies Canada - June 2018

While enjoying the Bay of Fundy coast, you've probably noticed thousands of sandpipers in late summer. Coastal beaches in the Minas Basin are vital places for Semipalmated Sandpipers and other shorebirds during their 4,000km migration to South America.

**Did you know: Semipalmated Sandpipers are in trouble - their population in the Bay of Fundy has declined by 50% since the 1970s, and they need our help.**

The Minas Basin of the Bay of Fundy is a critical stopover site for hundreds of thousands of Semipalmated Sandpipers and other Arctic-nesting shorebirds. It is designated as a Western Hemisphere Shorebird Reserve Network (WHSRN) site and an Important Bird Area (IBA) of global significance for fall migrant shorebirds. These shorebirds migrate from the Arctic to South America in the summer. They stop in the Bay of Fundy to eat twice their body weight and rest from mid-July to mid-September. At high tide, when water covers their feeding area, they look for coastal beaches to rest on, like The Guzzle and Avonport beach.

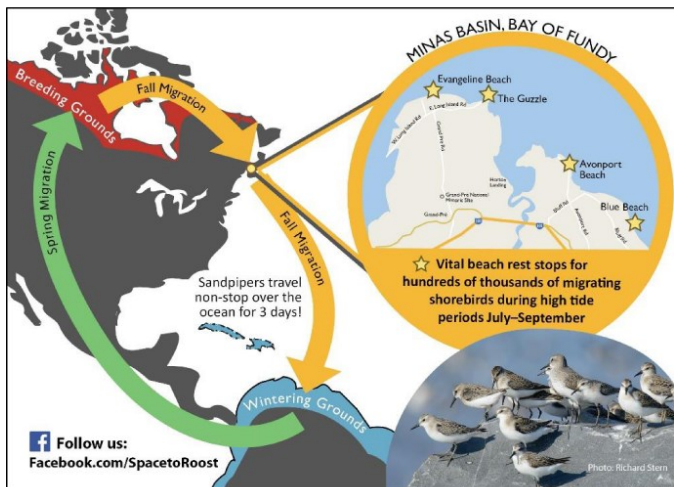


Image 1: Shorebird migration route and vital beach rest stops in Minas Basin

#### Why is safe resting space critical to shorebird survival?

Shorebirds are particularly vulnerable when they seek safe places to rest on the coast during high tide – often in large flocks. Summer recreation on the coast intensifies during peak shorebird migration mid-July to mid-September. Beach goers can disturb resting shorebird flocks by causing them to fly over water in search of safe resting sites. If shorebirds can't find a safe beach on which to land, they fly

around and waste vital energy reserves. Too much flying and not enough rest puts them in danger of running out of fuel during their epic, three-day over-ocean flight to South America (Image 1). Despite being shorebirds, they do not swim and so must fly 4,000 km non-stop.

To address these conservation challenges, Bird Studies Canada, a charity dedicated to conserving birds and their habitats, initiated the *Space to Roost Project* in collaboration with Blomidon Naturalists Society, Dalhousie University, NS Natural Resources, Canadian Wildlife Service and Eastern Habitat Joint Venture in summer 2016. Our goal is to reduce recreational pressures on shorebirds at important high-tide resting sites in the Minas Basin using a shared space approach with recreational users. We are



piloting this work at two sites: The Guzzle (near Evangeline beach) and Avonport Beach.

**Help shorebirds continue their migration**  
**Shorebirds can't swim, so they must be well-rested and well-fed to fly 4,000 km non-stop over the ocean to their wintering grounds in South America!**

**What months are shorebirds present?**  
 • Mid- July to mid- September (highest numbers in August)

**When is shorebird resting time?**  
 • 2 hours before to 2 hours after high tide (refer to tide chart on back side)

**How do I view shorebirds safely?**  
 • Use binoculars for a closer look  
 • Take photos with a telephoto lens

**How do I avoid disturbing resting flocks?**  
 • Stay as far away from flocks as possible  
 • Walk slowly when shorebirds are present  
 • Keep dogs on leash  
 • Explain to children why shorebirds need rest

**What else can I do to help shorebirds?**  
 • Keep beach litter-free (pick out used fishing line, hooks, bait, cans, bottles, plastics etc.)



Image 2: How to help shorebirds rest in the Minas Basin

**Avoid disturbing flocks during shorebird resting times**  
**Within 2 hours of high tide during peak migration (August 2018), Minas Basin**

August 1	02:29 - 06:29 14:52 - 18:52	August 11	00:00 - 02:57 11:27 - 15:27 23:52 - 24:00	August 22	00:00 - 00:19 08:47 - 12:47 21:10 - 24:00
August 2	03:11 - 07:11 15:35 - 19:35	August 12	00:00 - 03:52 00:45 - 04:45	August 23	00:00 - 01:10 09:36 - 13:36 21:57 - 24:00
August 3	03:56 - 07:56 16:20 - 20:20	August 13	13:12 - 17:12 01:37 - 05:37	August 24	00:00 - 01:57 10:22 - 14:22 22:41 - 24:00
August 4	04:44 - 08:44 17:10 - 21:10	August 14	14:04 - 18:04 02:29 - 06:29	August 25	00:00 - 02:41 11:04 - 15:04 23:22 - 24:00
August 5	05:37 - 09:37 18:05 - 22:05	August 15	14:55 - 18:55 03:21 - 07:21	August 26	00:00 - 03:22 11:45 - 15:45
August 6	06:35 - 10:35 19:03 - 23:03	August 16	15:47 - 19:47 04:13 - 08:13	August 27	00:05 - 04:03 12:24 - 16:24
August 7	07:35 - 11:35 20:03 - 24:00	August 17	16:40 - 20:40 05:07 - 09:07	August 28	00:42 - 04:42 13:02 - 17:02
August 8	08:36 - 12:36 21:03 - 24:00	August 18	17:34 - 21:34 06:03 - 10:03	August 29	01:21 - 05:21 13:41 - 17:41
August 9	09:35 - 13:35 22:01 - 24:00	August 19	18:29 - 22:29 06:59 - 10:59	August 30	02:01 - 06:01 14:21 - 18:21
August 10	00:00 - 02:01 10:32 - 14:32 22:57 - 24:00	August 20	19:25 - 23:25 07:55 - 11:55	August 31	02:42 - 06:42 15:04 - 19:04
		August 21	20:19 - 24:00		

Image 3: Minas Basin Tide Chart: Avoid disturbing shorebirds 2 hours before and after high tide in August

Beach in August.

Please join us July 30<sup>th</sup> to celebrate shorebirds with the Nature Conservancy of Canada. We're celebrating the Minas Basin's 30<sup>th</sup> anniversary as a Western Hemispheric Shorebird Reserve!

**Where:** 84 Evangeline Beach Rd, Grand-Pré

**When:** Monday July 30<sup>th</sup>, 2018 from 12:30 – 3:30pm

Celebrate with us while we raise awareness for declining populations of shorebirds and welcome visitors from other WHSRN sites, including: James Bay, the Jersey Shore, the Georgia Coast, Suriname and Paraguay. There will be snacks and refreshments, music, fun for the kids, and a presentation by Dr. Rob Clay, Director of the Executive Office of WHSRN. For more information on this celebration please contact Kerry Lee Morris-Cormier at the Nature Conservancy of Canada

[Kerry.Cormier@natureconservancy.ca](mailto:Kerry.Cormier@natureconservancy.ca)

**Space to Roost project partners and funders**

Space to Roost is led by Bird Studies Canada and Dalhousie University with support from partners: Blomidon Naturalists Society, NS Natural Resources, Environment & Climate Change Canada, and Nature Conservancy of Canada. Funding provided by The Government of Canada Habitat Stewardship Program, Commission for Environmental Cooperation, IBA Local Action Fund, Nova Scotia Habitat Conservation Fund Contributions from Hunters and Trappers, NS Natural Resources, and Blomidon Naturalists Society.

Learn more about Space to Roost at [Facebook.com/SpaceToRoost](https://www.facebook.com/SpaceToRoost) or contact us:

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**Sue Abbott** – Bird Studies Canada Atlantic Program Coordinator: [SAbbott@BirdsCanada.org](mailto:SAbbott@BirdsCanada.org)

**How can we help shorebirds rest?**

In 2016 and 2017, with the help of beach goers and nearby residents, we identified spaces at The Guzzle and Avonport Beach that supported resting shorebirds and had fewer recreational pressures. In 2017, using signs and outreach, we asked people to avoid these beach spaces from two hours before to two hours after high tide in August.

We were very pleased that human-caused disturbances to shorebirds declined on the designated "Shorebird Resting Beaches" from 2016 to 2017, with nearly all beach goers respecting signs and avoiding these areas from two hours before and after high tide in August 2017. We will be installing signs once again at The Guzzle and Avonport beach from August 1-31 this year, so please look out for them!

To learn more about how you can help shorebirds continue their migration (Image 2), as well as a tide chart detailing shorebird resting times in August (Image 3), please refer to our handout, which will be available at local businesses and tourist sites in the Grand Pré/Avonport area starting in July, and on site at the Guzzle and Avonport