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Assessing the ability of salt marsh prioritization tools to predict critical habitat for tidal marsh birds in NH

Report Prepared by Grace McCulloch, with Adrienne Kovach
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2023 Progress Report



Project Overview and Goals

As accelerated rates of sea-level rise threaten salt marsh persistence, there is increasing interest in restoration for the saltmarsh sparrow, a species of special concern in NH and a priority species for the US Fish and Wildlife Service and the Atlantic Coast Joint Venture (NHFG 2015; USFWS 2020; Hartley and Weldon 2020). The saltmarsh sparrow has experienced the steepest population declines (9% annually) observed in the tidal marsh bird community (Correll et al. 2016; Klingbeil et al. 2021) and is therefore a current focus of marsh restoration efforts. As NH coastal managers examine ways to prioritize restoration efforts for the saltmarsh sparrow and other vulnerable tidal marsh birds, three tools are being used to rank salt marshes based on habitat and sea-level rise resiliency. These include *Habitat Prioritization Tools* from Great Bay National Estuarine Research Reserve (GBNERR) and the Atlantic Coast Joint Venture that identify priority saltmarsh sparrow habitat. Additional tools include GBNERR's *NH Marsh Plan* that ranks marshes based on resiliency to sea-level rise, using characteristics of a marsh's current condition (e.g., degree of tidal restriction), vulnerability, and adaptation potential (migration). None of these tools have been ground-truthed with tidal marsh bird data. Our project addresses this key knowledge gap, examining the factors, including ranking of marsh resiliency and habitat by the tools, that predict critical habitat for saltmarsh sparrows. The overarching research goal is to identify features that best predict saltmarsh sparrow site use in New Hampshire and how they relate to the metrics currently used in priority habitat mapping for the species, as well as general sea-level rise planning. The project has four objectives it seeks to address:

1. Identify the features that best predict saltmarsh sparrow occupancy and relative abundance across NH salt marshes.

2. Characterize the relationship between the features identified as important for predicting saltmarsh sparrow occupancy and relative abundance in Question 1 and those comprising the tools currently used by managers via the Atlantic Coast Joint Venture and Great Bay National Estuarine Research Reserve priority habitat models.
3. Determine if marshes that are currently important to saltmarsh sparrows in New Hampshire (as measured by occupancy, relative abundance, and reproductive metrics) will be resilient to accelerated rates of sea-level rise and likely to persist beyond 2100, as projected by their ranking in the NH marsh plan.
4. Identify features that predict where nesting is likely to occur within a saltmarsh sparrow occupied marsh and whether remotely sensed data including marsh surface elevation, tidal range, and vegetation cover type can predict where nesting is likely to occur.

2023 Field Season Approach

In 2023, our field season approach was two-fold: (1) intensive nest searching and monitoring at key reproductive sites and (2) rapid demographic surveys. Through this approach we collected data to address research objective 4, building on 2021 and 2022 fieldwork that focused on point count surveys (10 minutes counts of all birds heard or seen) and rapid demographic surveys, collecting data to address research questions 1, 2, & 3. Each approach followed standardized Saltmarsh Habitat and Avian Research Program protocols. More information on those protocols can be found at www.tidalmarshbirds.org.

Nest Monitoring

Four sites were intensively searched for nests every 2-5 days. Sites included: Lubberland Creek Preserve (10.5 ha; Newmarket, NH), North Chapman's (9 ha; Stratham, NH), Philbrick's Pond (14.5 ha; North Hampton, NH) and Wallis Sands (6 ha; Rye, NH) (Figure 1). These were selected based on 2022 surveys identifying these among nine key reproductive sites for the species in NH. It is important to note that Chapman's Landing (Stratham, NH) the site with the highest density of saltmarsh sparrows in NH was not monitored this summer. This decision was made to give the site a fallow year after a decade of intensive research. Nest location data collected by UNH graduate student Talia Kuras in 2022 will be used as part of future analyses for this site.

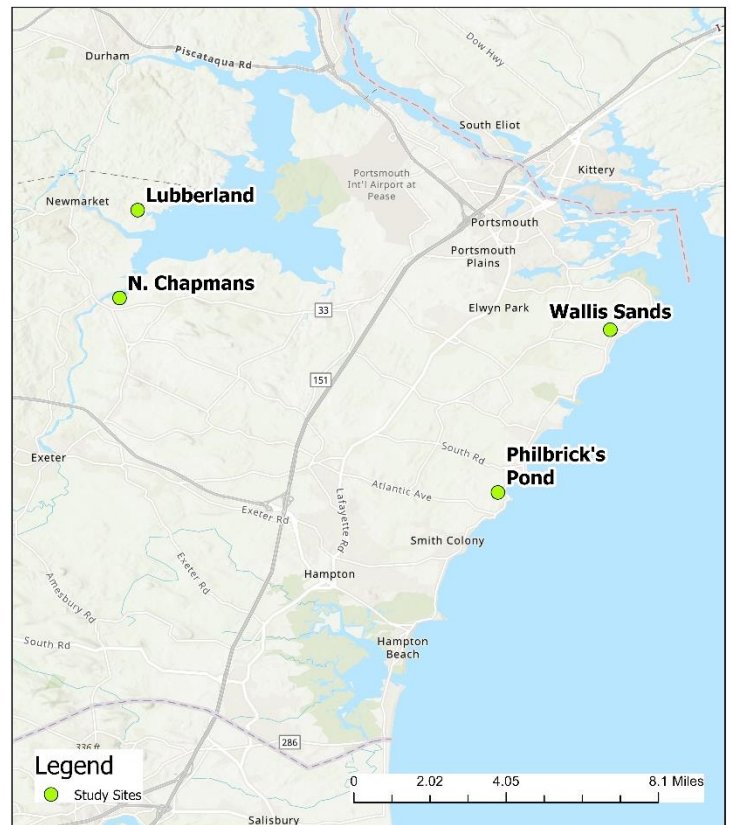


Figure 1. Sites of intensive nest searching and monitoring of saltmarsh sparrows (*Ammospiza caudacutus*) in New Hampshire in 2023. Rapid demographic surveys were also performed twice throughout the breeding season at each site.

Nest searching began on June 6th, 2023, and concluded August 31st, 2023, spanning 3 monthly tidal cycles. When a nest was found it was marked and checked every 3 to 4 days until fledging or failure to track nesting success. Nest fates were determined using a systematic key, following the methods of Ruskin et al. 2017. Accompanying vegetation surveys at all nests and paired random points were also conducted.

A total of 51 sharp-tailed sparrow nests were found and monitored across the four sites (Figure 2). In this report the term sharp-tailed sparrow will be used to refer to saltmarsh, Nelson's, and their hybrid sparrows, because the species identity of nesting females was not confirmed definitively. The majority of these nests, however, were likely associated with saltmarsh sparrows. Lubberland had the greatest number of nests (26), followed by Philbrick's Pond (12), Wallis Sands (9), and N. Chapmans (4). The locations of each of the nests we monitored are provided in the *Site Specific Comments* section at the end of this report.

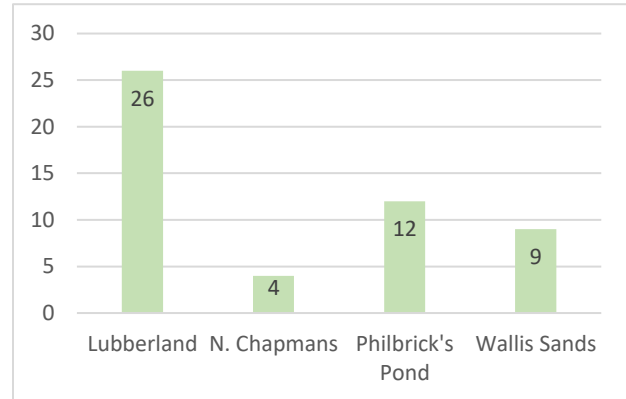


Figure 2. Total number of sharp-tailed sparrow nests monitored at each field site from June-August in New Hampshire.

Of these nests, 15 fledged at least one fledgling. Figure 3 provides a further breakdown of nest fate by site. Flooding was the primary cause of nest failure, attributed to 21 nests overall and occurring at a rate of 22-75% per site (although on the Wallis Sands site with 22% flooding, there was also a 56% failure rate due to unknown causes, suggesting that flooding may have been higher). Philbrick Pond had the highest predation rate (17%), which we suspect is due to a pair of river otters at the site. The Lubberland depredation (15%) was due to marsh wrens poking holes in eggs.

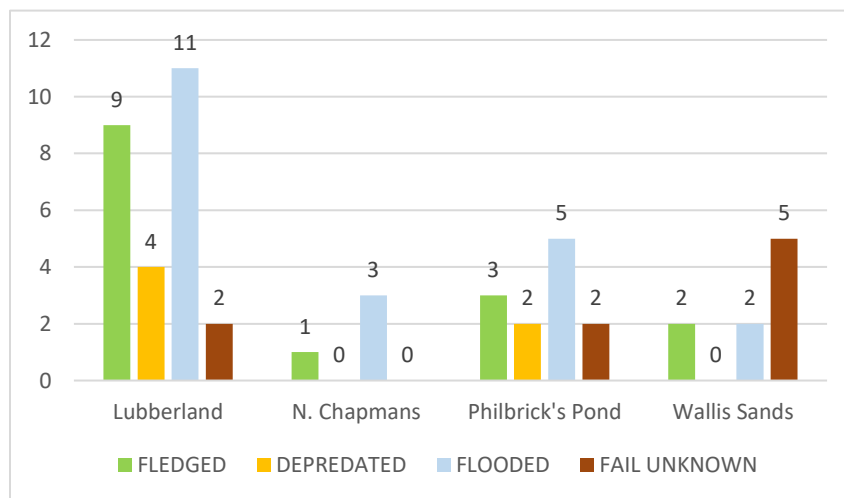


Figure 3. Ultimate fates of monitored sharp-tailed sparrow nests across four sites in New Hampshire. Fledged indicates at least one hatchling successfully fledged from a nest. Depredated indicates a nest that failed due to predation. Flooded indicates a nest failed due to flooding from rain or high tides. Fail unknown is applied in cases where it was unknown why a nest had failed or there was conflicting evidence.

Raw nesting success was low across the breeding season, ranging from 35% at Lubberland to 22% at Wallis Sands. In contrast, 2022 monitoring of Chapman's Landing (the most productive sparrow marsh in New Hampshire) found 52% raw nesting success. Heavy rain exacerbated existing vulnerabilities, with some nests flooding in advance of the Spring tides. June, July and August were the wettest three-month period on record for New Hampshire (NOAA 2023). The first cycle (ending with the full moon ~ July 4th) was particularly difficult with only one fledgling surviving. Water level logger data collected at each site may provide insight into this and will be explored.

In total we banded 40 chicks, 35 of which made it to fledging. At least three chicks successfully fledged at each site (Figure 4). We also documented an unusual case of a saltmarsh sparrow chick that failed to develop feathers at Lubberland. It made it to Day 12, successfully climbing out of its nest, acting normal in every other way, but did not survive the flood tides.

Together nest location, fate, and surrounding vegetation data will be used to identify the features that best predict where saltmarsh sparrow nesting is likely to occur (Research Objective 4). The vegetation data includes both field-based data and remotely sensed data from GBNERR's NH High Resolution Tidal Wetlands Mapper.

RTK elevation data will be collected in the fall of 2023, providing elevation of nests, paired random points, and each water-level logger. This effort will be collaborative with help from Shawn Herrick (UNH Facilities) and two undergraduate interns. Once collected these data will be used to identify if marsh surface elevation in conjunction with local tidal range (from onsite water-level loggers) can be used to predict where nesting is likely to occur (Research Objective 4).

Rapid Demographic Surveys

We conducted rapid demographic surveys at each of the four sites, twice between June and August (Figure 1). Rapid demographic surveys include 5 approaches: 1. point count (10 minute bird count) to identify any birds seen or heard; 2. systematic netting around the survey point (and additional target netting, if time allows) to capture as many adults or juveniles as possible; 3. walking transect across the survey plot to identify any birds seen/flushed; 4. vegetation survey including community/habitat cover classes, percent dominant vegetation species), as well as a transect for finer scale vegetation data; and 5. recording of any breeding behavior, nests, or signs of reproduction during the survey period. Combining each survey method allows for assessment of the potential for successful breeding at each salt marsh. Additional details on these protocols can be found at www.tidalmarshbirds.org. We also made notes on overall marsh quality with particular focus in the context of saltmarsh sparrow nesting.

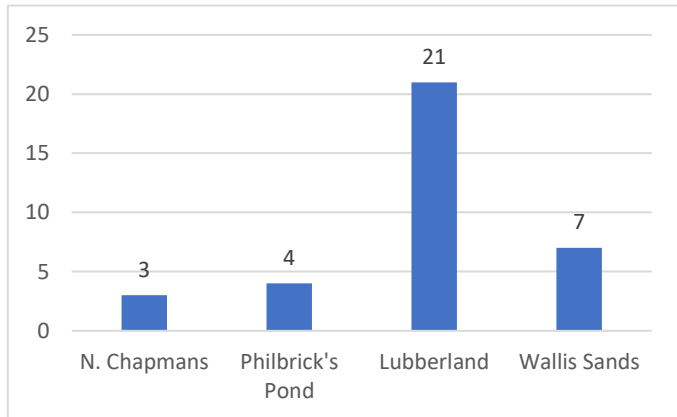


Figure 4. Total number of sharp-tailed sparrows that fledged at each field site in New Hampshire.

Table 1 provides a summary of our surveys across the two visits, accompanied by nesting totals from our intensive nest searching effort. At all sites, saltmarsh sparrows banded in previous years were recaptured this year, indicating each site continues to support saltmarsh sparrows throughout the breeding season. In total, we banded 1 hatch year and 27 adult sharp-tailed sparrows. Few hatch year and adult females were caught, despite multiple nests at each site. Noteworthy is the Lubberland Creek site, where no adult females or juveniles were captured and 26 nests were found. This suggests that the metric of the number of saltmarsh sparrow females caught in the rapid demographic protocol should be explored further. Nest searching in addition to netting may enhance the inferences that can be made about breeding; in the absence of nest searching, indicators of a salt marsh’s potential for reproduction may be missed, particularly on small and sparsely populated marshes.

Table 1. Detailed summary of rapid demographic surveys conducted in 2023 at four salt marsh sites in New Hampshire. Totals reflect the number of sharp-tailed sparrows from two demographic survey visits. Nest totals are the result of intensive nest searching throughout the season. Total recaps reflect the number of sharp-tailed sparrows caught this season that we caught or banded at the same site in a previous year.

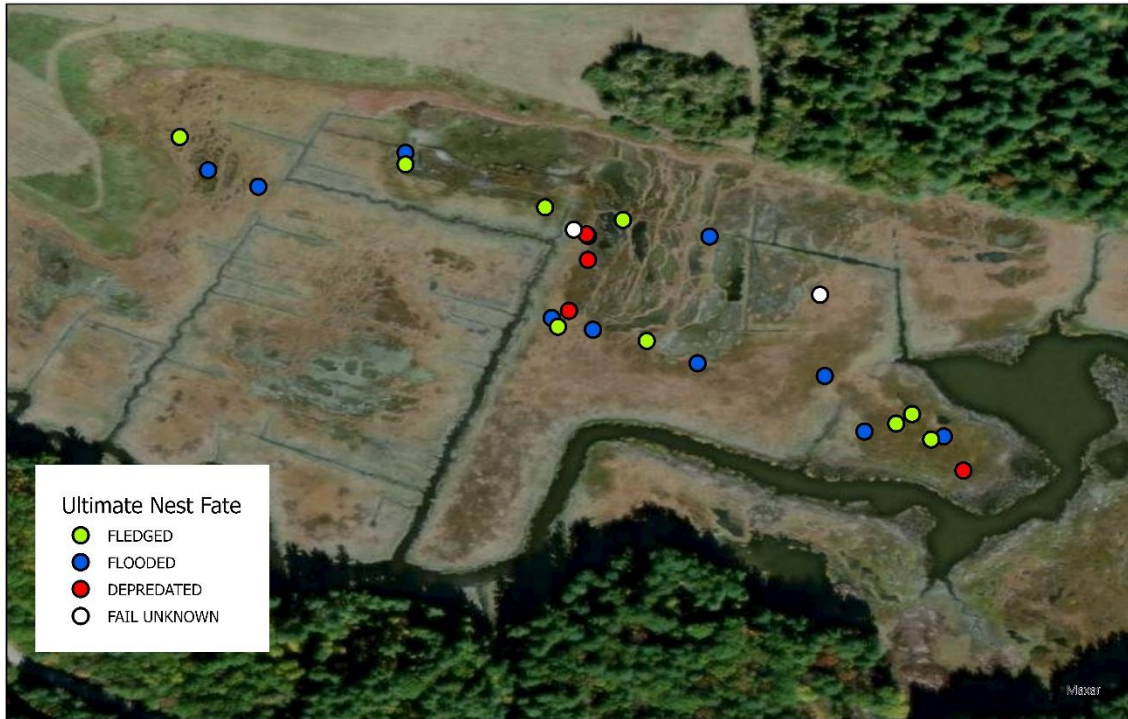
Site	Total adults captured	Total recaps from previous years	Total from transect survey	Total from point count surveys	Total males captured	Total females captured	Total juveniles captured	Total active nests	Breeding behavior
Lubberland	8	4	6	13	8	0	0	26	Calling/singing, chipping, copulation, Nelson's flight display
N. Chapmans	12	6	6	13	11	1	0	4	Calling/singing
Philbrick's Pond	11	4	1	2	7	3	1	12	Calling/singing, chipping, copulation
Wallis Sands	12	2	4	5	11	1	0	9	Calling/singing, copulation, Nelson's flight display

Site Specific Comments

Provided below are specific comments regarding each site’s condition, along with site specific maps indicating where nests were found this season and their fates.

Lubberland Creek:

Lubberland had the greatest proportion of saltmarsh sparrow nesting habitat. Pooling, however, is extensive and expanding, as we observed, along with Talia Kuras (UNH Masters student) and Bri Benvenuti (Ducks Unlimited), who monitored nests at the site in 2015. Saltmarsh sparrow nests were concentrated in three general areas (Figure 5), on the edges of these pool features.



Lubberland, Newmarket, NH

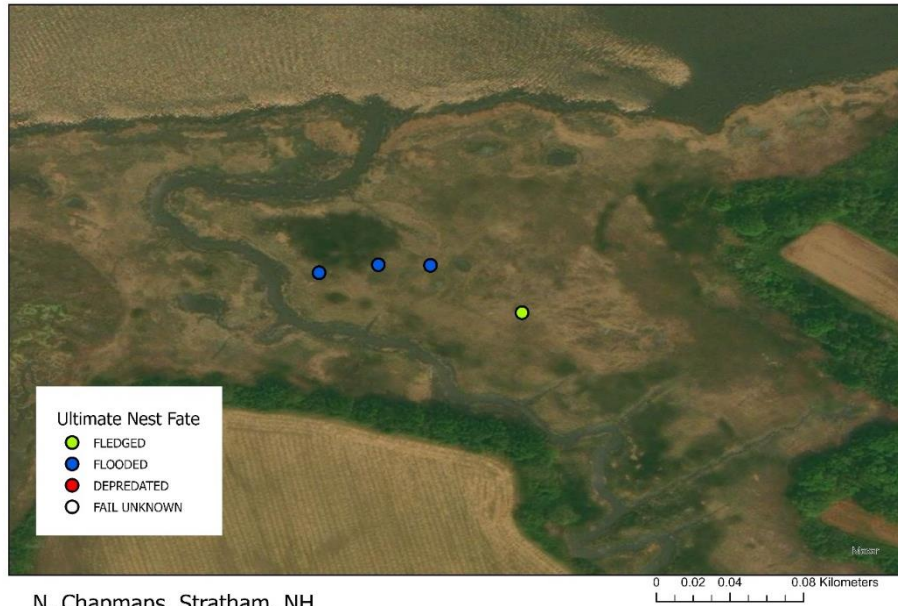
0 0.03 0.07 0.13 Kilometers

Figure 5. Nests monitored in 2023 at Lubberland salt marsh in Newmarket, New Hampshire.

Each circle represents the location of a sharp-tailed sparrow nest, with color indicating the ultimate fate of that nest. Fledged indicates at least one hatchling successfully fledged from a nest. Depredated indicates a nest that failed due to predation. Flooded indicates a nest failed due to flooding from rain or high tides. Fail unknown is applied in cases where it was unknown why a nest had failed or there was conflicting evidence.

North Chapmans (aka Stevens Marsh)

Despite an early season morning where 10 adult saltmarsh sparrows were caught, nesting was limited at this site. Several of those sparrows were birds banded across the channel on Chapman’s Landing by Talia Kuras in 2022. These may have been foraging across the channel at the time of capture. A key pocket of nesting vegetation is present, but other areas of the high marsh platform are dominated by short form *S. alterniflora*, an unsuitable nesting habitat (Figure 6). Several hatch years were seen on the opposite side of the bank near the North side of Chapmans, indicating successful reproduction across the channel.



N. Chapmans, Stratham, NH

Figure 6. Nests monitored in 2023 at N. Chapmans (also referred to as Steven’s Marsh) salt marsh in Stratham, New Hampshire. Each circle represents the location of a sharp-tailed sparrow nest, with color indicating the ultimate fate of that nest.

Wallis Sands:

Wallis Sands provided several pockets of nesting habitat, with nests clustered in these areas (Figure 7). The pools at this site, however, have expanded. Even within a year, the difference was marked. This marsh drains slowly and water becomes impounded at the Spring tide; the high marsh was a foot underwater at low tide. Only two nests successfully fledged at this site, with others making it to the chick stage, but not surviving the Spring tide nest flooding.



Wallis Sands, Rye, NH

Figure 7. Nests monitored in 2023 at Wallis Sands salt marsh in Rye, New Hampshire. Each circle represents the location of a sharp-tailed sparrow nest, with color indicating the ultimate fate of that nest.

Philbrick's Pond

Philbrick marsh is a site of ongoing restoration, with runneling that occurred in mid-August. We are excited to see what happens with this project and encourage continued saltmarsh sparrow monitoring, especially given the availability of pre-restoration data. Any future activities should occur outside of the May-September window, to preclude impacts to this vulnerable species. Existing embankments provide narrow strips of habitat where the saltmarsh sparrows currently nest (Figure 8). Ditch remediation is planned for later this year. While an effective technique, caution is warranted with respect to mowing, which removes the thatch layer. Thatch, a deep layer of dead, attached *Spartina patens* is a key feature of saltmarsh sparrow nesting habitat.



Philbrick Pond, North Hampton, NH

0 0.05 0.1 0.2 Kilometers

Figure 8. Nests monitored in 2023 at Philbrick's Pond salt marsh in North Hampton, New Hampshire. Each circle represents the location of a sharp-tailed sparrow nest, with color indicating the ultimate fate of that nest.

Additional Activities & Outreach

In her role at GBNERR as a Margaret A. Davidson Fellow, Grace McCulloch also participated in several outreach activities this summer. On June 9th we hosted a Saltmarsh Sparrow Training for tidal marsh monitors and managers in New Hampshire. 30 attendees enjoyed an outdoor field session learning to identify saltmarsh sparrows and an indoor session learning about on-going research and saltmarsh sparrow specific considerations for monitoring

and restoration. Presentations were made by Grace, Adrienne Kovach, Talia Kuras, Bri Benvenuti, and Rachel Stevens.

On July 4th Grace hosted Matt Aeberhard, a wildlife filmmaker, for a week of saltmarsh sparrow filming as part of his upcoming *Birds of America* film (more information available at: [Birds of America, How Birds Can Save Us](#)). We were also interviewed and photographed by Lauren Lambert and Bridget Huber as part of a long form journalism piece for National Geographic to be published in 2024. Each activity will help elevate saltmarsh sparrow in the conservation conversation and served as a unique learning opportunity.

We also collected feather samples for a project by colleagues at UCLA examining the impact of the Canadian wildfire smoke on feather condition.

Conclusions & Future Directions

While reproduction continues at several key salt marshes in New Hampshire, success is low, highlighting the vulnerability of saltmarsh sparrows. Flooding is only expected to increase as climate change accelerates sea-level rise and increases precipitation in New England. Together increased nest flooding and high marsh loss threaten saltmarsh sparrow persistence. Restoration is needed to support quality saltmarsh sparrow nesting habitat (a mix of high marsh grasses dominated by *Spartina patens*). Careful consideration, however, is needed when planning and implementing activities on marshes that currently support breeding saltmarsh sparrow populations. Local Saltmarsh Habitat and Avian Research Program collaborators including Adrienne Kovach (UNH) and Bri Benvenuti (Ducks Unlimited) can provide expertise during planning to minimize disturbance to saltmarsh sparrows and implement monitoring before and after restoration. The coming years provide an exciting opportunity to examine saltmarsh sparrow response to salt marsh restoration in an adaptive management approach.

The data collected during this field season will be used as part of Grace's master's thesis. This thesis will examine the features that best predict saltmarsh sparrow site use in New Hampshire and how they relate to the metrics currently used in priority habitat mapping for the species and general sea-level rise planning. Grace will address Research Objectives 1-4, which involve identifying predictors of saltmarsh sparrow occupancy and relative abundance, as well as characterizing saltmarsh sparrow nesting sites. The next steps in this work include data analysis, interpretation and the formal process of writing, editing, and submitting her thesis. The goal is to have this manuscript available later in 2024 to inform continuing salt marsh restoration as we seek to understand and conserve this species. This manuscript will be disseminated to our community partners both as a comprehensive report and through a series of presentations scheduled for the summer of 2024. Eventually, it will be submitted for peer review and publication.

Acknowledgements

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