

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

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2022 Progress Report
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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 for 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). Saltmarsh sparrows have experienced the steepest population declines (9% annually) observed in the tidal marsh bird community (Correll et al. 2016; Klingbeil et al. 2021). As NH coastal managers examine ways to prioritize restoration efforts for 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 *Marsh Prioritization Tool* that ranks marshes based 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 marsh habitat for saltmarsh sparrows.

This work builds on 2021 foundation established by Dr. Adrienne Kovach and Logan Maxwell, with USFWS funding, who collected data on tidal marsh bird occupancy and use across NH, an effort detailed in the 2021 Progress Report. In early 2022, Grace McCulloch joined the project, which will culminate in her Master's thesis and a peer reviewed publication. Grace is the Davidson Fellow at Great Bay National Estuarine Research Reserve and a Masters student at UNH in Kovach's lab. Together with Kovach, Rachel Stevens, and Cory Riley, we established a plan to continue the project with overarching and 2022 field season specific objectives.

Overarching Project Objectives (Grace's Masters thesis, funded by NOAA):

1. Assess the current occupancy and relative abundance of tidal marsh birds across NH salt marshes and assess saltmarsh sparrow reproduction at a subset of occupied NH marshes.
2. Identify if and how a marsh's ranking by the GBNERR's Marsh Prioritization Tool, GBNERR's Habitat Prioritization Tool, and/or ACJV's Habitat Prioritization Tool predict saltmarsh sparrow occupancy, relative abundance, and reproduction.
3. Document current marsh condition through vegetative surveys and other fine-scale habitat metrics, and determine their relationship with saltmarsh sparrow occupancy, relative abundance, and reproduction.

2022 Field Season Objectives (as funded by USFWS/WMI):

1. Resurvey all 2021 survey points across NH for robust detection and to obtain current data on salt marsh vegetation and tidal marsh bird occurrences.
2. Assess saltmarsh sparrow reproduction on a subset of occupied marshes by resurveying all 2021 rapid demographic locations and establishing new sites at areas with high saltmarsh sparrow density.
3. Complete the full two visits for all rapid demographic survey sites. *Due to logistical challenges, this could not be accomplished in 2021.*

Broadly, the project is designed to provide managers with an understanding of tidal marsh bird occupancy and relative abundance in NH and the factors that predict this. The data collected in the 2022 field season will further this goal. Ultimately, the project is intended to lead to more informed decision-making in salt marsh management for the benefit of tidal marsh birds.

2022 Field Season Approach

Avian Point Count Surveys

In 2021, 87 tidal marsh points were surveyed, including 25 new and 62 existing SHARP points. The Saltmarsh Habitat and Avian Research Program (SHARP) is a partnership of government, academic, and private organizations supporting 'the science behind tidal marsh bird conservation' across the saltmarsh sparrow's range (www.tidalmarshbirds.org). New survey points were identified in conjunction with NHFG, NH Audubon, and GBNERR to increase areal coverage in Hampton, Seabrook, and Rye, NH, gaps in the historical SHARP coverage of NH. In 2022, we conducted an avian point count survey at each of these 87 points, twice throughout the breeding season (Figure 1). Surveys were conducted from May 30th – August 2nd.

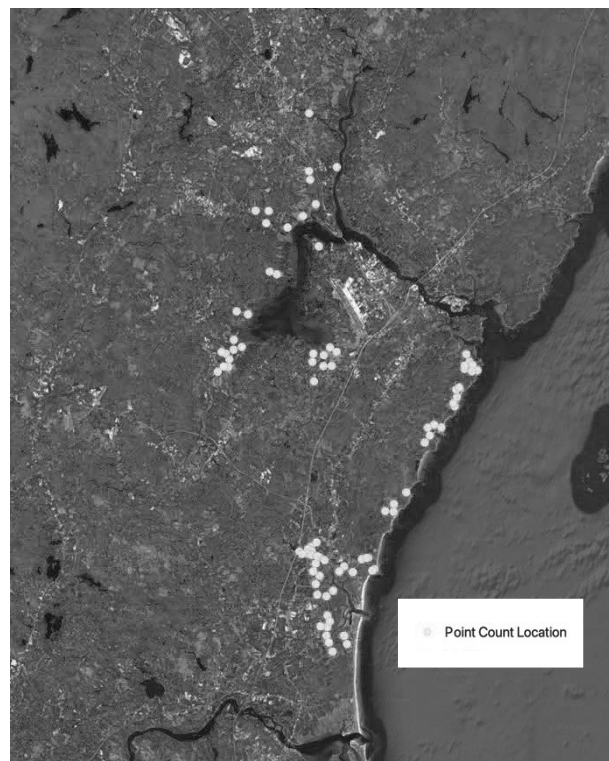


Figure 1. New Hampshire point count locations for 2021 and 2022, including 62 existing SHARP survey points and 25 new survey points.

Each survey consisted of a 5-minute passive bird count and a five minute broadcast sequence. All birds seen and/or heard using the salt marsh during these periods were recorded. The broadcast portion of this count includes a series of secretive marsh bird calls in intervals of a 30-second call and a 30-second window of silence to allow for birds to answer the playback call. Our surveys broadcast calls from five secretive marsh birds found in the region: Black Rail, Least Bittern, Sora, Virginia Rail, and Clapper Rail. Surveys were conducted between sunrise and 11AM and avoided times when weather may have influenced detection, including heavy wind, sustained rain, or dense fog. Surveys at the same point were conducted at least 10 days apart and followed established SHARP protocols (www.tidalmarshbirds.org).

Vegetation Surveys

A vegetation survey was conducted at each of the point count locations across New Hampshire during the second point count visit of the season, following established SHARP protocols (www.tidalmarshbirds.org). During this survey, community/habitat cover classes and percent dominant species cover were determined within a 50-meter radius circle around the point. Percent cover was estimated for each community type (low marsh, high marsh, saltmarsh or brackish terrestrial boarder, invasive species, panes/pools/creeks, open water, upland, and wrack) within the 50-meter survey plot using standardized cover classes (0%, <1%, 1-5%, 6-10%, 11-25%, 26-50%, 51-75%, and 76-100%). The number of dead snags within the plot was also noted. All vegetation species that covered more than 5% of the entire 50-meter radius plot were recorded, as estimated to the nearest 5%, to determine dominant species cover at each plot.

Rapid Demographic Surveys

We performed rapid demographic surveys twice throughout the breeding season at nine salt marshes across New Hampshire. Marshes were selected based on the previous year's surveys, consultation with collaborators, and the first round of 2022 point counts. Rapid demographic surveys were only conducted at locations with evidence of saltmarsh sparrow occupancy.

Seven of our nine 2022 rapid demographic sites were also surveyed in 2021 (Figure 2). Locations around Great Bay included Chapman's Landing, Lubberland Creek Preserve, and Chapman's North (a small marsh downriver from Chapman's Landing). Intensive demographic work was also conducted this summer by Talia Kuras (UNH Masters student) and her field crew at Chapman's Landing. We also conducted rapid demographic surveys at two locations

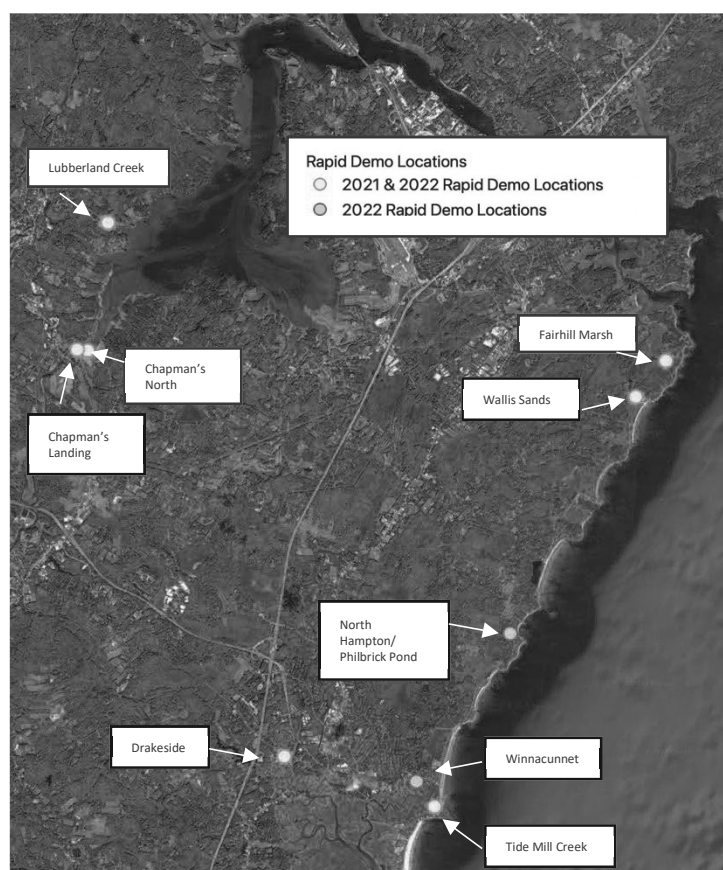


Figure 2. Saltmarsh sparrow rapid demographic surveys were conducted twice throughout the breeding season at nine salt marsh locations across New Hampshire. Yellow points indicate marshes where surveys were conducted in both 2021 and 2022. Blue points indicate new sites only surveyed in 2022. Each site is accompanied a site name.

in Rye: Wallis Sands and Fairhill Marsh. We added a new site in North Hampton (aka Philbrick Pond), where nests and saltmarsh sparrows were observed in 2021. In Hampton, we conducted surveys in the Great Marsh on the North side of Tide Mill Creek and on the marsh near Drakeside road further inland. These Hampton marshes were surveyed in 2021 and are referred to as Tide Mill Creek and Drakeside, respectively. We added a new location in Hampton, referred to as Winnacunnet, located on the Great Marsh near Winnacunnet Road. We also considered performing rapid demographic surveys at Awcomin marsh in Rye and on the Seabrook marsh complex, but little to no saltmarsh sparrow activity (a prerequisite for a rapid demographic survey) was observed on these marshes.

The rapid demographic protocol includes 5 survey approaches: 1. point count (as described above) to identify any birds seen or heard; 2. systematic netting around the survey point (and additional target netting, if time allows) to capture any 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 described above), 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. Additional details can be found at www.tidalmarshbirds.org. Combining each survey method allows for assessment of the potential for successful breeding at each salt marsh. Point counts alone can be biased toward male detection and only allow for the collection of presence/absence data, not breeding activity. We also made notes on overall marsh quality with particular focus in the context of saltmarsh sparrow nesting.

Accomplishments

Avian Point Counts & Vegetation Survey

We resurveyed all 87 of the 2021 survey points, conducting two independent point count surveys at each (Figure 1). We also surveyed an additional historical SHARP point count location on Great Bay. This point was not surveyed in 2021 and only surveyed once in 2022 due to logistical difficulties.

Sharp-tailed sparrows (STSP) were detected at 41 of the 88 points during one or both of the point count visits (Figure 3). Sharp-tailed sparrow detections included saltmarsh sparrows, Nelson's sparrows, and their hybrids. Because hybridization is widespread in New Hampshire, it is difficult to confidently detect pure saltmarsh sparrows from point counts, therefore we refer to all detections as sharp-tailed sparrow (STSP). Of the occupied points, the majority had 1-2 sharp-tailed sparrow detections.

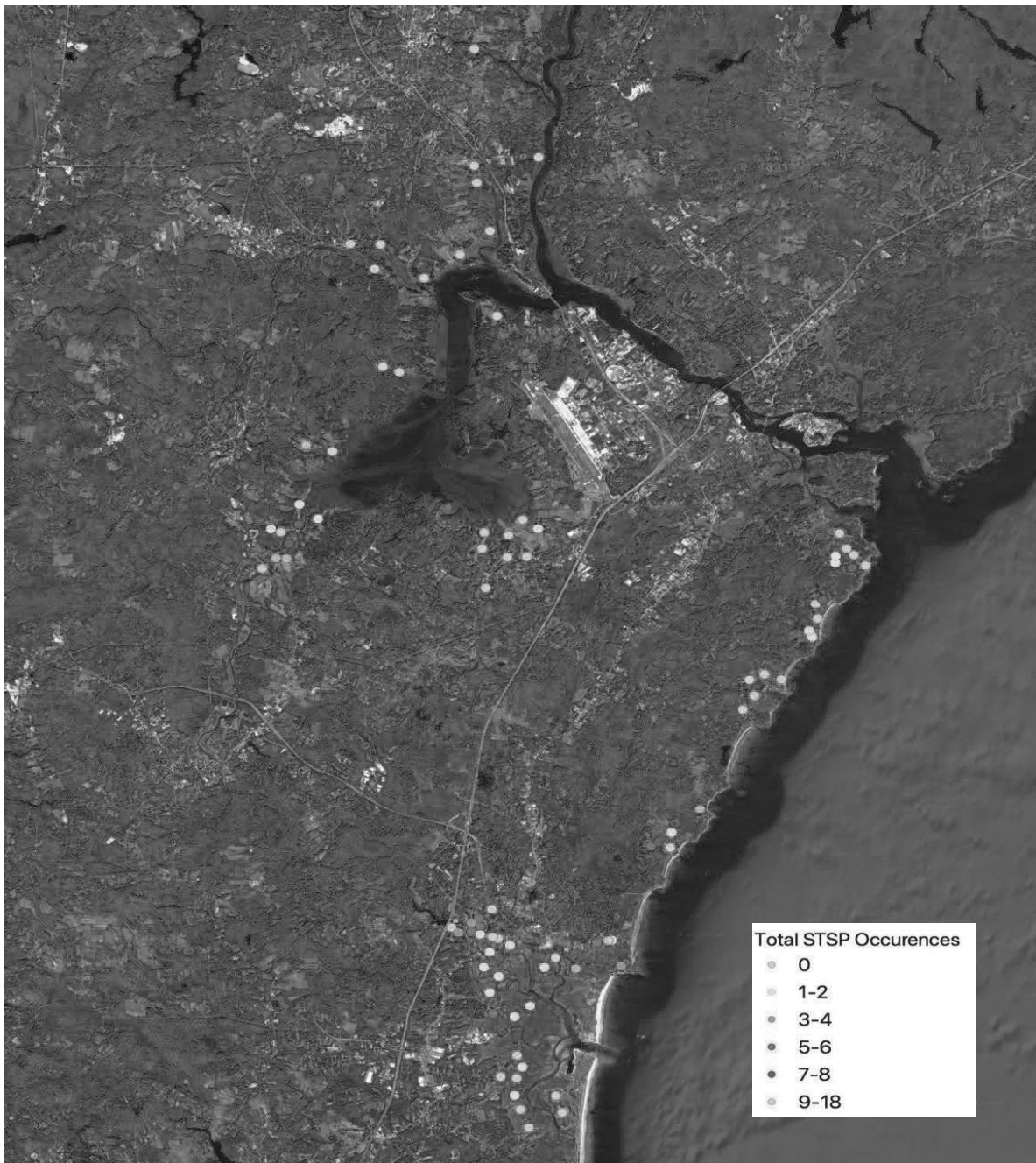


Figure 3. Total sharp-tailed sparrow occurrences across all point count locations and visits for 2022. Detections are rated by color for each survey point, with green representing no detections, yellow representing 1-2 occurrences, orange representing 3-4 occurrences, red representing 5-6 occurrences, purple representing 7-8 occurrences, and blue representing 9-18 occurrences.

Additional sharp-tailed sparrow detections included: 3 points with 3-4 detections, 6 points with 5-6 detections, and 5 points with 7-8 detections (Figure 3). The six survey points with the highest sharp-tailed sparrow detections included five of the rapid demographic survey sites: Lubberland Creek Preserve (14 detections), Chapman's Landing (18 detections), Chapman's North (12 detections), Winnacunnet (11 detections) and North Hampton (12 detections). An additional point in Hampton north of Route 101 had nine sharp-tailed sparrow detections. This site was initially considered as a rapid demographic survey location but was not pursued due to its close proximity to Route 101, which would have posed logistical and safety concerns.

We also detected Virginia rail at 5 of the 88 points during one or both of the point count surveys (Figure 4). All Virginia rail detections were on Great Bay and ranged from one to five occurrences. No other SHARP focal species, including black rail, least bittern, sora, and clapper rail were detected at any of the survey points.

Rapid Demographic Survey

We conducted rapid demographic surveys at nine salt marshes across New Hampshire, twice throughout the breeding season. Figure 2 shows the locations for each survey. See Table 1 for a summary of our findings. Below is a detailed discussion of the data collected on each of the nine rapid demographic study sites. Transect walks for vegetation and bird counts were a challenge. New Hampshire marshes have many pools, ditches, and channels that can make walking in a straight line difficult and may have influenced detection. Any mention of nests in this report only includes nests with eggs, chicks, or the remains of egg or chicks from the 2022 breeding season. This does not include partial nests or nests from prior seasons, unless otherwise noted.

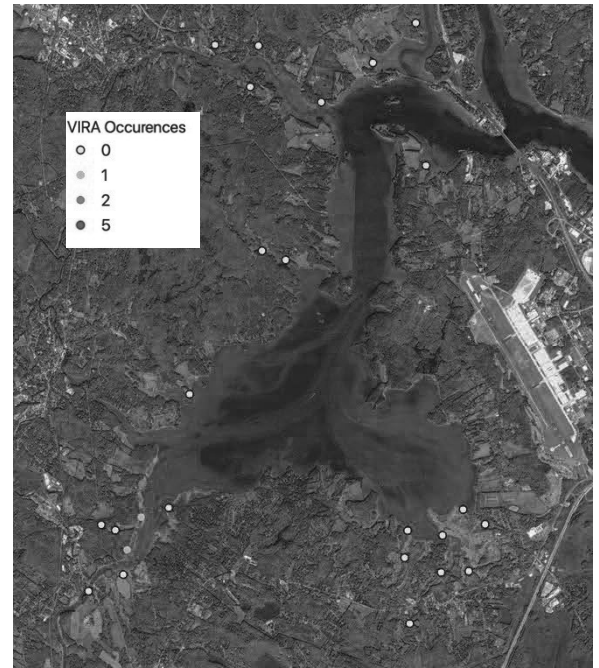


Figure 4. Total Virginia rail occurrences during 2022 point count surveys. Occurrences only shown in Great Bay, NH, since no Virginia rail were detected at any of the other NH locations during point counts. Detections are rated by color for each survey point, with yellow representing no detections, orange representing one occurrence, red representing two occurrences, and purple representing five.

Table 1. Detailed summary of rapid demographic surveys conducted in 2022 at nine salt marsh sites in New Hampshire. Totals reflect the number of sharp-tailed sparrows or nests from two rapid demographic survey visits. Total recaps reflect the number of sharp-tailed sparrows caught this season that were also captured or banded at the same site in 2021.

Site	Total captured	Total recaps from 2021	Total from transect survey	Total from point count surveys	Total males captured	Total females captured	Total juveniles captured	Total active nests	Other breeding behavior observed
Fairhill	13	0	3	7	12	1	0	1	call/singing, chasing, flight display, flightless chicks, carrying fecal sacs, carrying food
Wallis Sands	15	2	8	8	10	3	2	2	calling/singing, chasing, copulation, flight display
North Hampton	10	0	6	12	6	3	1	4	calling/singing, chipping, chasing, copulation
Tide Mill Creek	16	6	7	8	15	1	0	1	calling/singing
Drakeside	10	5	12	5	7	3	0	1	calling/singing, chasing, flight display
Winnacunnet	12	0	7	11	8	4	0	2	calling/singing, chasing, copulation
Chapman's North	7	2**	2	12	4	3	0	5	calling/singing, chasing
Lubberland	11	2	10	14	7	4	0	7	calling/singing, carrying food, carrying fecal sacs, copulation, flight display
Chapman's Landing	10	5	15	18	7	3	0	61*	calling/singing, chasing, flight display

* Total number of sharp-tailed sparrow active nests for Chapman's Landing reflects an intensive nest monitoring effort by an additional field crew

** Total number of recaptures (recaps) from 2021 for Chapman's North indicate sharp-tailed sparrow caught and/or banded at Chapman's Landing in 2021.

Great Bay: Lubberland Creek Preserve

Lubberland Creek was surveyed in 2021 and was the site of intensive demographic work for SHARP in 2012 through 2015 (Figure 2). It has large areas of high quality nesting habitat with scattered pools. This site had one of our greatest nest abundances, with seven nests distributed throughout the marsh. One nest contained 4 chicks, one had 5 eggs, four had 4 eggs, and one had three eggs. We had 14 sharp-tailed sparrow detections during our point count visits and caught 11 unique sparrows over the two visits, 7 males and 4 females (Table 1). Two individuals were recaptures, banded in previous years. We also observed a diversity of breeding behaviors including: singing/calling, carrying food, carrying fecal sacs, copulation, and flight display. All signs pointed to a marsh where saltmarsh sparrow reproduction continues to occur. Though it is important to note that when we returned later in the season to check the nests, we found that some of the nests had been flooded out with the remains of chicks nearby.

Great Bay: Chapman's Landing

Chapman's Landing was the only site surveyed twice in 2021. We resurveyed the site in 2022, capturing 10 unique sharp-tailed sparrows, 7 males and 3 females (Figure 2, Table 1). Chapman's Landing has been a site of intensive monitoring since 2011 and had a UNH field crew led by Talia Kuras conducting a full rapid demographic study of the site. In 2022, they captured 175 sharp-tailed sparrows, including 37 newly captured adults, 6 juvenile captures, and 96 nestlings banded at their nests. The crew also monitored 61 sharp-tailed sparrow nests throughout the breeding season. With over 10 years of intensive demographic work, Chapman's Landing has been identified as an important breeding site for saltmarsh sparrows in New Hampshire. Breeding behaviors we observed included calling/singing, chasing, and flight display. High quality nesting habitat is available, despite substantial pools in the high marsh.

Great Bay: Chapmans North

Chapmans North was also surveyed in 2021 and is separated from Chapman's Landing by a channel (Figure 2). High marsh and good quality nesting habitat were abundant at this productive marsh, where seven sharp-tailed sparrows were captured, four male and three female (Table 1). Of these one of the birds captured was originally banded as a nestling in 2021 and another was a 2021 recapture from the adjacent marsh (Chapman's Landing) demonstrating movement between neighboring marshes. We observed many signs of breeding including 1 old and six active nests scattered across the marsh platform and calling/singing and chasing breeding behaviors. One active nest contained 4 eggs and four nests contained 3 eggs.

Rye: Fairhill Marsh

A rapid demographic survey was conducted at Fairhill marsh in 2021 (Figures 2 and 6). In our 2022 point counts, no sharp-tailed sparrows were found at this location. Consequently, we moved our Fairhill site to a point further inland on the same marsh (Figure 6). Both areas had an abundance of short form *Spartina alterniflora* which alone is not high quality STSP nesting habitat. A few STSP were detected at this point, but no sparrows were caught during systematic netting. A pocket of high-quality nesting habitat was located within ~100 meters of the point, located directly off Pollock Drive. Targeted netting here resulted in the capture of 13 unique sharp-tailed sparrows, 12 male and 1 female (Table 1). One nest was found with 4 eggs. Several juveniles were also seen. We observed a diversity of breeding behaviors including chasing, flight display, flightless chicks, carrying fecal sacs, carrying food, and singing/calling.

Rye: Wallis Sands

Wallis Sands was resurveyed from 2021 (Figure 2). It was one of the wettest marshes we surveyed, very unstable to walk on, and with numerous pools and mudflats covered in *Salicornia* sp. There were, however, strips of high marsh nesting habitat available. 15 unique sharp-tailed sparrows were captured (10 males, 3 females, and 2 juveniles), our second highest total (Table 1). Two adults were recaps, banded during last year's rapid demographic surveys. This site had our highest total of juveniles caught, indicating that despite the wet conditions, successful reproduction occurred. Calling/singing, copulation, flight display, and chasing were observed and two active nests were found at the site, one with 2 eggs and one with 4 eggs.

North Hampton (aka Philbrick Pond)

The North Hampton site was added in 2022 (Figure 2). It is an isolated piece of marsh with forest on one side and houses along Ocean Blvd on the other. A wide channel and pond divide the marsh into two pieces and many pools cover the high marsh platform. Targeted netting was used at two locations on the far side of this channel, in addition to the systematic netting, to cover these additional areas. Isolated patches of high marsh border this wide channel and a few larger patches exist in areas not dominated by the many pools. The strips of marsh that are not water or mud flats, are however, stable to walk on unlike marshes like Wallis Sands or Tide Mill Creek.

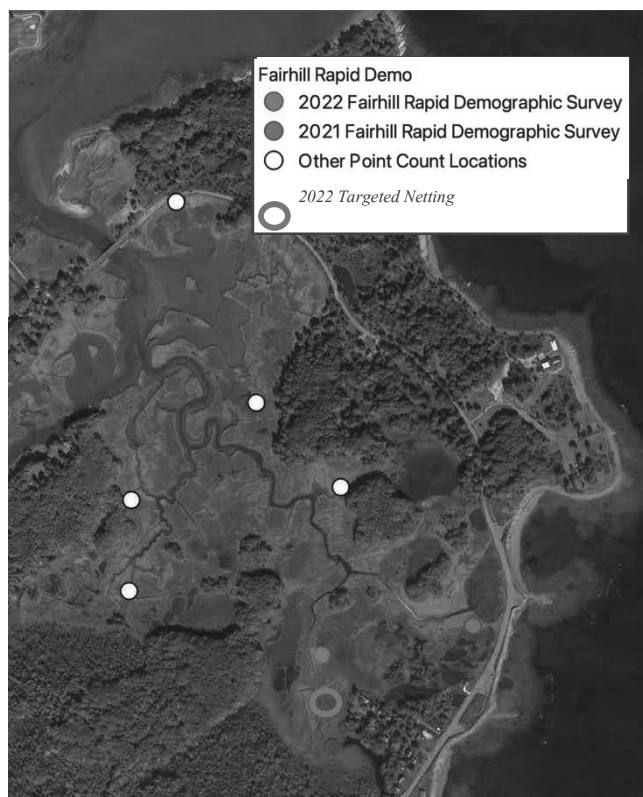


Figure 6. Rapid demographic survey locations for 2021 and 2022 and other point count survey locations on Fairhill Marsh in Rye, NH. White points indicate additional point count locations, the blue point indicates the 2021 rapid demo location, and the red point the 2022 location. The circle outlined in red indicates where additional targeted netting was conducted in 2022 during as part of the surveys and is where all 2022 sharp-tailed sparrow captures were from for Fairhill.

We captured 10 unique sharp-tailed sparrows during our visits (six males, three females, and one juvenile; Table 1). Four nests were found at the site. Nest contents included: 1 egg (2 nests), and 3 chicks (aged 1 day), 4 eggs, and 4 chicks (aged 4-5 days). Breeding behaviors including calling/singing, chipping, chasing, and copulation were observed. This site had our field season's only case of dispersal. Male saltmarsh sparrow (band number 2811-29733) was captured during both our site visits. SHARP records indicate this sparrow was banded as a nestling on Drake's Island Marsh in Maine in 2021 by Bri Benvenuti with the USFWS.

Hampton: Tide Mill Creek

Tide Mill Creek, a site on the Great Marsh on the North side of Tide Mill Creek, is a very wet, subsided marsh, but like in the 2021 surveys it had a high relative abundance of sharp-tailed sparrows (Table 1). Unstable to walk on, only a few pockets of suitable nesting habitat could be located. Large pools/pannes and *Salicornia sp.* patches exist in this area. Tide Mill Creek had the highest number of sharp-tailed sparrows caught at a site during our season, 16 (Table 1). It is important to note that only one of these individuals was female and only one active nest with four chicks was found. Two other partial or old nests were found at the site. When we returned to the site we could not find the active nest, despite substantial searching. The nest had no canopy and was very close to the ground. It is our suspicion that the nest was destroyed with the flood tide. Six of the 16 sparrows captured were banded during last year's rapid demographic surveys, indicating sparrows are returning to this site, despite apparent low quality habitat. Calling/singing breeding behavior was also observed.

Hampton: Winnacunnet

This site was added in 2022 (Figure 2). We created a new SHARP point at the site in order to survey a pocket of marsh with many sharp-tailed sparrows. In addition to systematic netting, we performed targeted mist netting to capture additional sparrows. In total we captured twelve unique sharp-tailed sparrows, 8 males and 4 females (Table 1). We also found two nests and observed calling/singing, chasing, and copulation. This area had abundant high marsh, with few pools, little low marsh vegetation, and a firm marsh platform. There was *Phragmites australis* encroachment, however, at the end of our vegetation transect near Winnacunnet road, posing a threat to this high marsh. One of the homeowners mows the *Phragmites* on the marsh in front of their property. In other areas bordering the marsh it is dense.

This case illustrated a stark contrast in sparrow relative abundance over just a few hundred meters of marsh. The nearby point count location on the same marsh only had 2 sharp-tailed sparrow detections across both visits, compared to 11 at Winnacunnet (Figure 4).

Hampton: Drakeside

This site was resurveyed from 2021 (Figure 2). This marsh has many holes, with almost a pit and mound structure, and is wet even at low tide. There is some high marsh nesting habitat, but there is also a substantial section of tall-form *Spartina alterniflora*, that the sparrows fly back and forth to from the high marsh. Trees in the adjacent forest are beginning to die, indicating possible marsh migration. Early in the season there was a lot of activity at this site. We observed calling/singing, chasing, and copulation. Despite this, we only found one nest with 4 chicks. We captured 10 unique sparrows, 7 male and 3 female (Table 1). Of the sparrows captured, five were banded at the site last year.

Conclusions

Overall, sharp-tailed sparrow occurrence was low, in contrast to the abundance of saltmarsh sparrow habitat indicated by New Hampshire mapping tools. Some marshes in Rye (Awcomin marsh), Seabrook, and Hampton, appeared to provide high quality habitat during our vegetation surveys, but had few to no sharp-tailed sparrow detections. At other marshes, the reason for low occupancy was clear: marshes had a subsided, overall wet condition with pooling and expansive areas of short-form *Spartina alterniflora* (which alone is not suitable habitat). Sharp-tailed sparrows were left to occupy small suitable patches within the broader marsh complex. Of the locations occupied by sharp-tailed sparrows, even fewer supported breeding populations. Only nine marshes with breeding activity and nesting could be identified, underscoring the infrequency of saltmarsh sparrow occurrence and the importance of key reproductive sites for the species' conservation in New Hampshire. Further investigation of saltmarsh sparrow habitat is warranted to explain the inconsistent pattern in occupancy we observed. Given the saltmarsh sparrow's vulnerability, careful consideration is also needed if and when restoration activities are sited at the marshes currently supporting breeding populations, to ensure activities create conditions that continue to support productive breeding.

Future Directions

In September of 2023 a report will be provided to the USFWS and interested stakeholders outlining preliminary analysis of the relationships between the vegetation data and the saltmarsh sparrow metrics collected during this field season. It will also identify initial findings on the relationships between the rankings by the tools and the saltmarsh sparrow metrics. Further, refinement, with modeling, will be conducted by Grace in the second year of her Master's thesis, to characterize the habitat and tool metrics that best predict marshes important to the saltmarsh sparrow in New Hampshire (with outside NOAA funding). The results of these analyses will be available in the form of a peer reviewed publication and Master's thesis. Great Bay National Estuarine Research Reserve will also work with Grace to ensure her research findings are distributed to coastal managers in New Hampshire. The ultimate goal of this effort is for more informed decision making in New Hampshire for the benefit of vulnerable tidal marsh birds. A greater understanding of saltmarsh sparrow occupancy, relative abundance, and reproduction in NH and how tools and vegetation metrics can predict habitat for this species, will be a key piece in ongoing sea-level rise planning for salt marshes and coastal communities in the state.

Acknowledgements

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References

- Correll, M. D., W. A. Wiest, T. P. Hodgman, W. G. Shriver, C. S. Elphick, B. J. McGill, K. M. O'Brien, and B. J. Olsen. 2016. Predictors of Specialist avifaunal decline in coastal marshes. *Conservation Biology*, 31(1): 172-182.
- Hartley, M. J., and A. J. Weldon, eds. 2020. Saltmarsh sparrow conservation plan. Atlantic Coast Joint Venture, acjv.org/documents/SALS_plan_final.pdf.
- Klingbeil, B. T., J. B. Cohen, M. D. Correll, C. R. Field, T. P. Hodgman, A. I. Kovach, E. E. Lentz, B. J. Olsen, W. G. Shiver, W. A. West, and C. S. Elphick. 2021. High uncertainty over the future of tidal marsh birds under current sea-level rise projections. *Biodiversity and Conservation*, 30: 431-443.
- New Hampshire Fish and Game (NHFG). 2015. New Hampshire Wildlife Action Plan, Appendix A: Birds, Saltmarsh Sparrow. <https://www.wildlife.state.nh.us/wildlife/profiles/wap/birds-saltmarshsparrow.pdf>
- U.S. Fish and Wildlife Service (USFWS). 2020. Report on the current conditions for the saltmarsh sparrow. August 2020. U.S. Fish and Wildlife Service, Northeast Region, Charlestown, RI. 106 106 pp.