Saltmarsh Sparrows Successfully Breed in an Urban Tidal Marsh Habitat in the New Jersey Meadowlands

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Introduction

The east coast of the United States contains a wide variety of tidal marsh habitats with a diversity of avian species inhabiting them (Correll et al. 2016). These marshes have been subject to decades of exploitation and destruction by external anthropogenic influences. Over half of the tidal marshes on the Atlantic Coast were drained or filled between 1950 and 1970 alone for a variety of reasons such as insect control and development (Dahl 1990, Tiner 1984). These losses are particularly evident in urban ecosystems such as those within the greater New York Metropolitan area and are exacerbated by a combination of factors. These include sea level rise and urban expansion which is directly related to sediment starvation and ultimately marsh fragmentation (Gornitz et al. 2001, Hartig et al. 2002, Peteet et al. 2018).

The Saltmarsh Sparrow (*Ammospiza caudacuta*) is endemic to the Atlantic Coast of the United States and is widely considered one of the most rapidly declining avian species in the Western Hemisphere (Correll et al. 2017). Population estimates over time suggest the species declined at an alarming rate of 9% per year between 1998 and 2012 for an overall decline of ~87%. (Correll et al. 2017). The greatest threat to this sparrow is sea level rise caused by anthropogenic climate change (Bayard and Elphick 2011). Models suggest that this threat could push the species to total population collapse by the middle of the 21st Century (Field et al. 2017, 2018).

Saltmarsh Sparrows rely on high marsh habitat dominated by Salt Hay (*Spartina patens*), Salt Grass (*Distichlis spicata*), and a variety of other specialist coastal plants for breeding (Shriver et al. 2010). This type of habitat typically floods once or twice a month during extreme high tides

to which this species has naturally adapted its breeding cycle (Bayard and Elphick 2011, Bertness and Ellison 1987, Shriver et al. 2007). However, a foot or more of sea-level rise in some areas has led to decreased nesting success due to tidal inundation (Bayard and Elphick. 2011, Gjerdrum et al. 2008, Correll et al, 2017). This threat is broadly applicable to all ground-nesting birds in tidal marshes in northeastern North America but particularly for Saltmarsh Sparrows because of their highly specialized breeding habitat requirements (Gjerdrum et al. 2005, 2008, Ruskin et al. 2017a, Shriver et al. 2007).

Records of Saltmarsh Sparrow presence in the New Jersey Meadowlands date back to at least 1997 when bird surveys were conducted in the Harrier Meadow Wetland Enhancement Site as part of a pre- and post-restoration study (Seigel 2005). New Jersey Sports and Exposition Authority's Meadowlands Research and Restoration Institute (NJSEA-MRRI) biologists went on to find breeding evidence at as many as four different sites across the district as recently as 2017 (Figure 1) (eBird 2021). Biologists working on the 2021 Meadowlands Breeding Bird Atlas found the species at only one of those sites with no evidence of breeding success (McQuade et al. 2022). This rapid local decline can likely be attributed to degradation of habitat for a variety of site-specific reasons including increased ground cover of invasive plants such as Common Reed (*Phragmites australis*) and native upland plants such as Groundsel Tree (*Baccharis helimifolia*). This has possibly degraded quality high marsh habitat for Saltmarsh Sparrows in a very short amount of time.

The tidal marshes of the New Jersey Meadowlands exhibit a long history of exploitation and pollution but also one of great ecological resistance and resilience to increasing anthropogenic pressures (Kiviat and MacDonald 2004, Tsipoura et al. 2011, Artigas et al. 2017). In particular, the high marshes of the area are highly fragmented but continue to persist. However, avian

diversity is highest overall in large, continuous tracts of high quality habitat (Stephens et al. 2004). This is particularly true for tidal marsh specialists breeding in salt marshes (Shriver 2002). Any shrinking makes successful reproduction more difficult for tidal marsh obligate species (Bayard and Elphick 2011, Shriver 2002).

Distinguishing between sites with successfully breeding Saltmarsh Sparrows and those with either unsuccessful attempts or only presence is important (Meiman et al. 2012). This is especially true in light of the U.S. Fish and Wildlife Service's proposal to list the species as Endangered. In light of the Atlantic Coast Joint Venture's prioritization of Saltmarsh Sparrow research and restoration, the primary objectives of this study were (1) to obtain a minimum index of adult individuals using Meadowlands high marsh sites during the 2023 breeding season, (2) to assess the current breeding status of the species at Meadowlands District high marsh sites, and (3) to make findings available for reference by local and regional entities (Hartley and Weldon 2020). These results will form the foundation of future Saltmarsh Sparrow research and habitat restoration in the Meadowlands.

Study Area

Riverbend Wetland Preserve ("Riverbend") is a 54-acre site located at the southern extreme of the Meadowlands District directly along the Hackensack River. Riverbend itself is the last known site occupied by Saltmarsh Sparrows throughout the breeding season (McQuade et al. 2022). Even still, this habitat, primarily dominated by *S. patens*, shrinks every year due to the steady colonization of *P. australis*. The site consists of 4 discrete islands separated by mosquito ditches, each containing a significant percent cover (>50%) of *S. patens*-dominated high marsh habitat (Figure 2). For this study, the islands were named 1 through 4 according to their geographic position from north to south (Figure 2). No standardized Saltmarsh Sparrow-specific breeding

surveys have been conducted on this site. A passive survey in 2017 yielded at least seven adults present during the breeding season (Turso 2017). Experienced biologists working on the 2021 Meadowlands Breeding Bird Atlas found just 2 individuals during 1 visit (McQuade et al. 2022).

Methods

Two to three experienced birders went to high marsh sites to search for and count adult Saltmarsh Sparrows and look for nesting activity from late May until early August 2023. Each of the four islands were surveyed at least once per month and at most twice per week with prioritization given to those with suspected or confirmed breeding activity. Upon arrival, metadata such as start time, weather conditions, and observers present were recorded. All Saltmarsh Sparrows present were counted throughout the visit. Observers were careful to not double count any individuals. Multiple teams were simultaneously present on adjacent islands to ensure Saltmarsh Sparrows were not double counted if they crossed creeks. Surveys occurred between sunrise and 9:00. All count data were entered into a spreadsheet in Microsoft Excel via a Galaxy Tablet (Table 1).

Along with the indexing procedures, breeding activity was surveyed following the signs of breeding guidelines in SHARP's standard operating procedure (Roeder 2019). Birders formed a line standing at arm's length apart and walked in a straight line across the high marsh (Ruskin et al. 2017b). When a Saltmarsh Sparrow was flushed at close range, the area was noted and searched for a nest (Ruskin et al. 2017b). However, nest searching itself was limited in order to minimize disturbance to this small and isolated group of Saltmarsh Sparrows; the goal was only to see how many birds were nesting and successfully raising young to fledging. The islands with suspected breeding activity were checked at least once a week and the highest breeding code observed per visit was entered into a spreadsheet in Microsoft Excel via a Galaxy Tablet (Table 2) (Sullivan et

al. 2009). The widely-accepted breeding code system used by the Cornell Lab of Ornithology's Project eBird as well as many by breeding bird atlases across North America was used to characterize the breeding status associated with Saltmarsh Sparrow observations (Table 3, Sullivan et al. 2009).

Results & Discussion

Riverbend was surveyed for Saltmarsh Sparrow adult count and breeding data a total of 11 times between 25 May 2023 and 3 August 2023. The highest minimum count of adults across all 4 islands on a given day was 8. This count was observed on 15 June 2023 and 29 June 2023 (Table 1). Additionally, two other Meadowlands high marsh sites, Harrier Meadow and Marsh Resources Bank, were surveyed 3 times between 22 May 2023 and 30 June 2023 but yielded no Saltmarsh Sparrow observations.

Island 1 was surveyed 10 times between 25 May 2023 and 3 August 2023. The highest minimum count of adult Saltmarsh Sparrows here was 3 (Table 1). This number occurred on 29 June 2023 (Table 1). On 15 June 2023 one bird was flushed twice from a dense patch of *S. patens* at approximately 40.7529296, -74.0929351 and immediately returned both times, suggesting this was a female on a nest (Figure 2, Table 2). This location was checked again on 22 June 2023 and the bird behaved similarly but poor weather conditions limited the time spent surveying (Table 2). On 29 June 2023, this individual was seen carrying food into the nest area and leaving with fecal sacs, definitively confirming there was a nest with young present. On 6 July 2023, this female was heard chipping and seen dropping food off at multiple locations near the nest area. A single young fledgling was then observed and identified based on plumage and poor flight ability (Table 2). On both 13 and 20 July 2023, presumably the same female was seen feeding 2 fledglings near the nest area at 40.7532634, -74.0928946. This confirms that this female Saltmarsh Sparrow successfully

raised young to fledging. On 26 July 2023, a female Saltmarsh Sparrow was observed carrying food into a different patch of *S. patens* at approximately 40.7534452, -74.0933737 and leaving with fecal sacs, indicating that another nest with young was present (Figure 2). This area was checked on 3 August 2023, but no fledglings or adults were present. Therefore, the outcome of this nest is unclear. However, 2 mature fledgling Saltmarsh Sparrows were observed being fed in the same area as 13 and 20 July 2023, suggesting they were likely the same individuals as before (Figure 2, Table 2). These observations confirm that Saltmarsh Sparrows successfully raised young to fledging on Island 1.

Island 2 was surveyed 5 times between 25 May 2023 and 26 July 2023. A single singing male Saltmarsh Sparrow was observed here on 6 July 2023 (Table 1, 2). Likely the same singing male was observed here again on both 20 and 26 July 2023. There were no further observations of Saltmarsh Sparrows on this island during the 2023 breeding season. However, a nesting female from Island 1 frequently flew across the mosquito ditch to Island 2 and returned to the nesting area with food, indicating that she foraged here.

Island 3 was surveyed 9 times between 25 May 2023 and 6 July 2023. The highest minimum count of adult Saltmarsh Sparrows here was 2 (Table 1). This number occurred on 15 June 2023 and 22 June 2023 (Table 1). On 25 May 2023, a single singing male was observed (Table 2). On 1 June 2023, a single unvocal individual was observed (Table 1, 2). No observations occurred during surveys on 12 June 2023 (Table 1, 2). Surveys on 15 June 2023 yielded observations of a female carrying food and dropping it off multiple times in a patch of *S. patens* at approximately 40.7513669, -74.0919162. However, no fecal sacs were observed after dropping off food. Therefore, it is unknown whether this female was feeding nestlings or fledglings. But this observation confirms that she was raising young. No further breeding observations occurred

on this island except the presence of birds in appropriate habitat on 22 and 29 June as well as 20 and 26 July 2023 (Table 2).

Island 4 was surveyed 10 times between 25 May 2023 and 3 August 2023. The highest minimum count of adult Saltmarsh Sparrows here was 4 (Table 1). This number occurred on 12, 15, and 29 June as well as 26 July 2023 (Table 1). On 25 May 2023, a single singing male was observed (Table 2). On 1 June 2023, a singing male was observed again. An unvocal individual was also flushed at approximately 40.7507042, -74.0911582 and returned both times, suggesting it could be a female on a nest (Figure 2, Table 2). This same behavior occurred on 12, 15, 22, and 29 June 2023 in the same area, but there were no observations of confirmed breeding behavior during those surveys (Table 2). On 6 July 2023, this individual displayed the same behavior but also gave chipping calls. This behavior continued on 20 July 2023. A second potential nest area was also identified on this island when a Saltmarsh Sparrow flushed at close range and returned soon after (Figure 2). This area was quickly vacated due to its close proximity to an active Osprey (*Pandion haliaetus*) nest, so no further observations occurred that day. However, on 26 July 2023, a total of 3 fledglings were observed here. One was being fed near the Osprey platform at 40.7508795, -74.0920762, and 2 were being fed by a different female at 40.7509399, -74.0908782 (Figure 2, Table 2). The fledgling near the Osprey platform appeared older than the other 2 based on plumage and flight ability. 3 fledglings were observed being fed again on 3 August 2023 in the same areas (Figure 2, Table 2). These observations confirm that Saltmarsh Sparrows successfully raised young to fledging on Island 4. Additionally, a singing Seaside Sparrow (*Ammospiza maritima*) was observed here on 12 June 2023. This bird actively chased Saltmarsh Sparrows as it moved around the island.

Overall, a minimum of 8 individual adult Saltmarsh Sparrows were present at Riverbend during the 2023 breeding season. These data show that there are more individuals present here than previous observations suggest (McQuade et al. 2022). Breeding survey observations confirm that multiple females raised young to fledging. Observations of 5 total fledglings on Islands 1 and 4 on 3 August 2023 confirm that a minimum of 5 individuals fledged from nests at Riverbend. This confirms that Saltmarsh Sparrows are able to successfully recruit new individuals into the population using this marsh. If Saltmarsh Sparrow is listed as Endangered by the U.S. Fish and Wildlife Service, Riverbend may be designated as critical habitat and warrant federal protections. Therefore, the conservation implications of these results are potentially significant. Regardless, MRRI will now prioritize Meadowlands Saltmarsh Sparrow research as well as habitat preservation and restoration to support the range-wide effort to save this species from extinction.

Future Direction and Plans

Tables and Figures

Date	Island 1	Island 2	Island 3	Island 4	TOTAL
5/25/2023	0	0	1	1	**2**
6/1/2023	0	n/s	1	2	**3**
6/12/2023	n/s	n/s	0	4	**4**
6/15/2023	2	0	2	4	**8**
6/22/2023	2	n/s	2	2	**6**
6/29/2023	3	n/s	1	4	**8**
7/6/2023	2	1	0	1	**4**
7/13/2023	1	n/s	n/s	n/s	**1**
7/20/2023	1	1	2	3	**7**
7/26/2023	1	1	1	4	**7**
8/3/2023	2	n/s	n/s	3	**5**

Table 1: Counts of adult Saltmarsh Sparrows collected during breeding surveys on 4 high marsh islands at Riverbend Wetland Preserve from 25 May 2023 to 3 August 2023 with ‘n/s’ indicating a lack of surveys on a given day.

Date	Island 1	Island 2	Island 3	Island 4
5/25/2023			S	S
6/1/2023			H	N
6/12/2023				N
6/15/2023	N		CF	N
6/22/2023	H		H	H
6/29/2023	FS		H	H
7/6/2023	FY	S		H
7/13/2023	FY			
7/20/2023	FY	H	H	N
7/26/2023	FS	H	H	FY
8/3/2023	FY			FY

Table 2: Breeding codes associated with Saltmarsh Sparrow observations during breeding surveys on 4 high marsh islands at Riverbend Wetland Preserve from 25 May 2023 to 3 August 2023 with a blank space indicating no observations. Only the highest breeding codes per island per day are listed. See Table 3 for breeding code definitions.

H - In Appropriate Habitat (Possible)
S - Singing Bird (Possible)
N - Visiting Probable Nest Site (Probable)
CF - Carrying Food (Confirmed)
FL - Recently Fledged Young (Confirmed)
FS - Fecal Sac (Confirmed)

Table 3: Relevant breeding code definitions, taken from the Cornell Lab of Ornithology's Project eBird, associated with Saltmarsh Sparrow observations during breeding surveys on 4 high marsh islands at Riverbend Wetland Preserve from 25 May 2023 to 3 August 2023 (Sullivan et al. 2009).

Figure 1: Map showing sites with Saltmarsh Sparrow observations during the breeding season only in 2017 versus both 2017 and 2021.

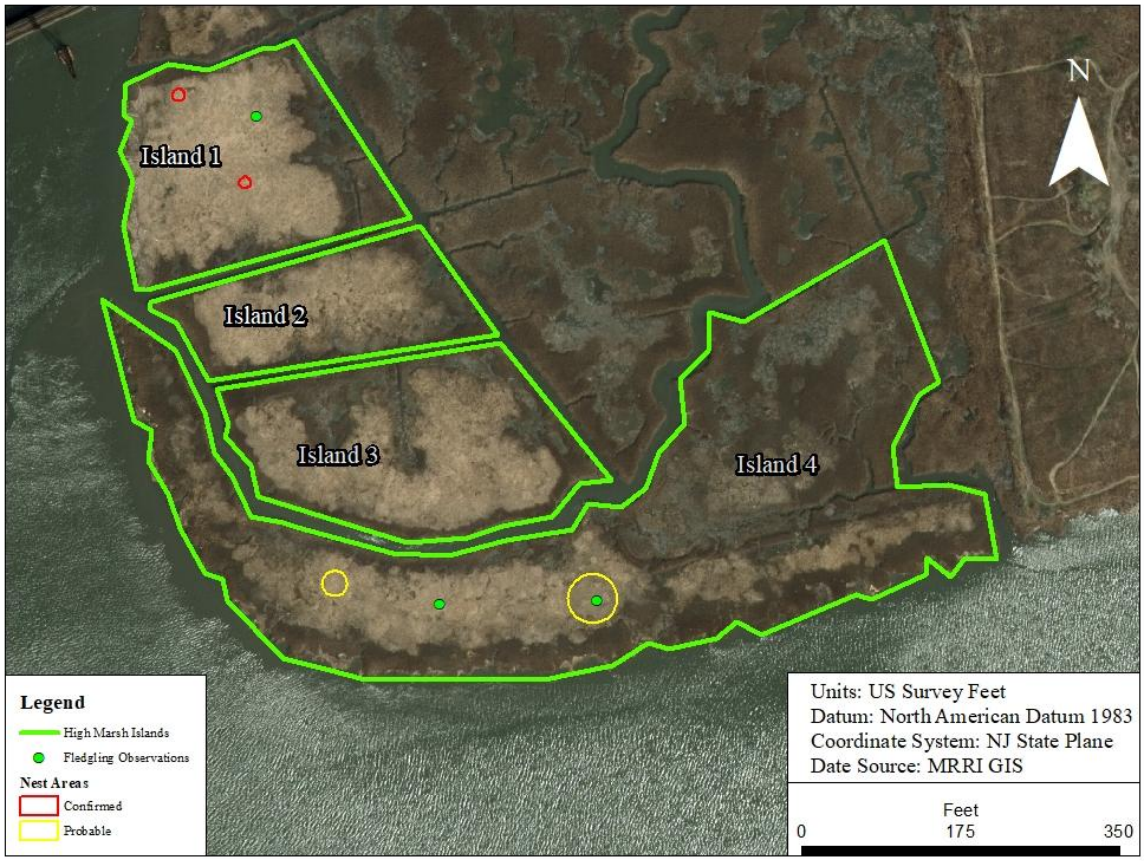

Figure 2: Map of Riverbend Wetland Preserve showing the 4 discrete islands separated by mosquito ditches, the points at which fledgling Saltmarsh Sparrows were observed being fed, as well as the confirmed and probable nest locations narrowed down to the indicated circular areas. All observations occurred between 25 May 2023 and 3 August 2023.

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