2021

USFWS winter marsh sparrows Delmarva

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Recommended Citation

Hines, C. H., L. S. Duval, and B. D. Watts. 2021. USFWS winter marsh sparrows Delmarva. Center for Conservation Biology Technical Report Series: CCBTR-21-04. William & Mary, Williamsburg, VA. 21 pp.

WINTER ABUNDANCE AND SURVIVAL OF SHARP-TAILED SPARROWS AT THE EASTERN SHORE OF VIRGINIA NWR: YEAR 2021 REPORT

THE CENTER FOR CONSERVATION BIOLOGY

WILLIAM & MARY

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Project Partners:

United States Fish and Wildlife Service
The Center for Conservation Biology
William & Mary

Front Cover: A Saltmarsh Sparrow captured at Bull Marsh during January 2021. Photo by Laura Duval.

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

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EXECUTIVE SUMMARY

The wintering and migratory periods are the most poorly understood intervals of a songbirds' life, yet they also account for significant mortality. A lack of information about these periods hampers our ability to conserve habitats that support birds and mitigate mortality. In an effort to better understand the factors that influence sharp-tailed sparrow winter ecology, we have established rope-drag sampling transects to reveal what parameters influence abundance, implemented a mark-recapture program to quantify survival, and measured several vegetation characteristics of marshes on the Eastern Shore of Virginia National Wildlife Refuge (ESVNWR) and Fisherman Island National Wildlife Refuge (FINWR).

During the winter of 2020-2021, we observed a total of 81 Sharp-tailed Sparrows, 1 Seaside Sparrow, and 1 Marsh Wren during the rope-drag sampling transect surveys. Total birds observed on transects decreased from 36 in period 1, to 24 in Period 2, and 23 in Period 3. The most birds were observed during the first survey period, followed by period 2 and 3, respectively. Of the 83 birds detected, 70 were detected on the initial pass and 13 on the return pass. Detection on days with the mean daily low temperature (39® F) was 0.87 (±0.04). Abundance was relatively consistent among sites in 2021 (mean = 12.59 birds per transect, ±0.13), but was lower and not as consistent among sites during 2013-2014 (mean = 10.00, ±1.83, Figure 4C). Vegetation characteristics were not useful in explaining bird abundance and were not different between control plots and bird observation locations. However, nearly all seeds were disseminated from seed heads by late February.

During the three capture periods we accumulated 42 Saltmarsh Sparrow captures, 91 Nelson's Sparrow captures, 3 Seaside Sparrow captures, and 1 Marsh Wren was captured. Of those captured, 113 were newly banded, 1 bird was a foreign recapture, and 33 birds were within season recaptures. Recapture probability for both Nelson's and Saltmarsh Sparrows was 0.56 (±0.14). Survival varied between marsh locations and species, but was greater for both species at all locations between the first and second capture periods. For Saltmarsh Sparrows, survival declined from 0.51 (±0.27) between capture period 1 and capture period 2 to 0.12 (±0.09) between capture period 2 and capture period 3 at Bull Marsh, 0.69 (±0.28) to 0.22 (±0.22) at the ESVNWR boat ramp, and 0.90 (±0.14) to 0.53 (±0.31) at FINWR. For Nelson's Sparrows, survival declined from 0.51 (±0.27) between capture period 1 and capture period 2 to 0.12 (±0.09) between capture period 2 and capture period 3 at Bull Marsh, 0.69 (±0.28) to 0.22 (±0.22) at the ESVNWR boat ramp, and 0.90 (±0.14) to 0.53 (±0.31) at FINWR.

BACKGROUND

The suite of species utilizing tidal saltmarsh habitat in the Chesapeake Bay region during winter is of high conservation concern. Included in this suite are the Saltmarsh Sparrow (*Ammospiza caudacuta*), Nelson's Sparrow (*A. nelsoni*), and Seaside Sparrow (*A. maritima*). All of these species fall into several high priority bird conservation lists, including the Atlantic Coast Joint Venture Salt Marsh Bird Conservation Plan (ACJV 2019), Virginia Wildlife Action Plan (VDGIF 2015), and the Mid-Atlantic Partners in Flight Coastal Plain Bird Conservation Plan (Watts 1999). In addition, the Saltmarsh Sparrow is one of three species under the Atlantic Coast Joint Venture's Flagship Species Initiative with an estimated 80% population decline in just the last 15 years (ACJV 2019).

Research on the status and distribution of these species has primarily focused on the breeding season. However, few studies have examined the migratory and wintering portions of their life cycle despite the fact that marsh sparrows may spend up to six months on winter areas during a period that may be most critical for adult survival. Several forms of marsh sparrow species that emanate from different breeding locations can be found wintering in the Chesapeake Bay Region, including all three subspecies of Nelson's Sparrows *(A. n. alterus*, *A.n. nelsoni, and A. n. subvirgata)*, both subspecies of Saltmarsh Sparrows (*A. c. caudacuta and A. c. diversus*), and the nominate Seaside Sparrow subspecies (*A. m. maritima*). A 2014 study conducted by The Center for Conservation Biology revealed that Virginia appears to be an important wintering area for these marsh sparrows (Watts and Smith 2015). Several of these marsh sparrow taxa appear vulnerable to threats that include sea-level rise, extreme flooding events, tidal ditching, and development. Saltmarsh Sparrows are particularly sensitive to these threats and some biologists have predicted a global population collapse within the next 50 years (Correll et al. 2017).

The goal of this project is to estimate survival and abundance for marsh sparrows at an important wintering location, the southern tip of the Delmarva Peninsula. The results of this study provide a comparison to a 2014 study and allow us to determine what factors may influence habitat use and overwinter survival.

OBJECTIVES

The overarching goals of this project are to:

1) Quantify and compare sharp-tailed sparrow abundance with that found during a 2014 survey.

2) Quantify and compare overwinter survival between marshes.

3) Determine whether vegetation characteristics are associated with greater sharp-tailed sparrow abundance.

METHODS

Study Area

Field work occurred on the Eastern Shore of Virginia National Wildlife Refuge (ESVNWR, Figures 1 and 2) and Fisherman Island National Wildlife Refuge (FINWR, Figure 3). Sampling locations chosen within the study area were consistent with those used during a marsh sparrow project during the 2013-2014 winter (Smith et al. 2014). All sampling areas were low marsh habitat dominated by *Spartina alterniflora* (hereafter, '*spartina')* bordered by high marsh habitat dominated by *Spartina patens*, *Iva frutescens*, *Morella spp.,* and *Baccharis halimifolia*.

Figure 1. Transect and trapping locations adjacent to the boat ramp at the Eastern Shore of Virginia NWR.

Figure 2. Transects and trapping locations at Bull Marsh at the Eastern Shore of Virginia NWR

Figure 3. Transects and trapping locations at Fisherman Island NWR.

Sparrow Density Surveys

We used a standardized rope drag transect (Peterson and Best 1985) to sample marsh sparrow density. Transects were 60 m wide (rope distance) and 250 m long (Figures 1 – 3). We surveyed the same transects as were surveyed in 2014 to aide in comparison. Each transect was surveyed once in each of the sampling periods: 2 December – 3 December, 13 January – 14 January, and 25 February – 26 February, for a total of 3 surveys at each site. Surveys were conducted between mid-falling and mid-rising tide to avoid any biases produced by high tide inundation that potentially moves birds out of lower marshes and into high marsh roosting habitats (Paxton 2007).

Rope drags are designed to increase the detection probability by flushing birds hidden within dense vegetation. We implemented a double-pass technique that would help determine detection probability by comparing the detection decay rate between the first and second pass. A transect was walked by three people, with two stationed on either end of the rope and one walking down the middle. On the initial pass all detected birds were registered and tracked to determine if they flushed off the transect. A reverse pass was made immediately after to detect any additional birds missed by the first pass. Detections of Nelson's and Saltmarsh Sparrows were combined simply as "Sharp-tailed Sparrow" because of difficulty in discerning these two species visually on flush surveys. Additionally, we marked every initial location from where birds flushed and placed a pin flag at the location for follow-up vegetation measurements.

Sparrow Capture

Sparrows were captured at each site once per sampling period: 2 December – 4 December, 13 January – 15 January, and 25 February – 27 February, for a total of 3 capture at each site. We used portable mist nets that were erected where sparrows concentrated at tidal highs near transect sampling locations. These areas (i.e., roosts) included high marsh points, relatively tall patches of *spartina*, and isolated patches of wrack (Figures 1 – 3). After nets were erected, we drug a rope through the marsh near the nets to flush birds to the roosts and then flushed birds from the roosts into the nets. Once captured, we banded sparrows with a standard USGS tarsal band and a unique combination of color bands. Morphometric measurements taken included: wing chord (mm), tail length (mm), culmen length (0.1 mm), tarsus length (0.1 mm), and mass (0.1 g). Age was determined using a combination of feather wear and structure and skull pneumatization when possible. We also took 3 – 5 body feathers to analyze for sex determination.

Vegetation Characteristics

At every location where sparrows were flushed during the density surveys, and at 10 randomly selected control points, we measured *spartina* density (stem count and ocular estimation), height of the tallest *spartina* stem, and counted the number of *spartina* seed heads that held seeds within a circular plot measuring $0.65m^2$. Vegetation surveys at bird detection locations were conducted immediately following transect surveys and controls were conducted during the second period of surveys in January.

Statistical Analyses

We calculated density using the package ‘unmarked’ (Fiske and Chandler 2011) in program R (R Core Team 2020) using generalized multinomial N-mixture models (Royle et al. 2004). We treated our rope drags as removal experiments where birds flushed from transects on the initial drag were “removed” and birds we encountered on the return drags were newly encountered birds.

We fit models with a variety of predictors in all three functions and at each step we chose the most parsimonious model determined by the lowest AIC score. We first fit models that only included predictors in the detection function to determine if the environmental factors wind, daily high tide, daily high temperature, daily low temperature, or wind speed affected the likelihood of detecting birds. We then included predictors using characteristics of *spartina* at vegetation plots because sharp-tailed sparrows depend on this marsh species in winter (Michaelis 2009). These vegetative predictors include mean height of *spartina*, mean *spartina* stem count, total number of seeds on transects, marsh locations, and transect identity in the availability function (probability that birds are available for detection) to determine if any vegetation characteristics influenced availability. Because we were interested in comparing abundance in the three marsh areas, we included marsh identity in every model and evaluated whether the inclusion of transect site and vegetation predictors improved fit. Because no habitat predictors were included in our final 2020-2021 model, we included the 2014 data as well as a categorical predictor for year. We also included interactions between year and marsh location and transect identity to account for differential changes in abundance or availability.

We used Kendal rank correlation test to determine if stem counts and ocular estimates were correlated. We used a Mann-Whitney-Wilcoxon test to compare stem counts taken at controls and those taken at bird locations. We used a Wilcoxon signed-rank test to compare seed availability between control plots and bird location plots during the second survey period. We used a Kruskal-Wallis test to compare seed availability (number of seed heads supporting seeds) between survey periods.

We calculated apparent survival and recapture probability using the package ‘marked’ (Laake et al. 2013) in program R (R Core Team 2020). We constructed models that included marsh location (Bull marsh, ESVNWR boat Ramp, FINWR), sparrow species, an interaction between the marsh and sparrow species to account for species specific differences in survival at each marsh, time of season and the bird’s body condition upon initial capture (scale of 0 – 5) within the survival function. We included species, high tide amplitude to account for the greater need to leave the low marsh during higher tides, and daily low temperature within the recapture probability function. We also included models with only intercepts to ensure we were not overfitting models. We used the most parsimonious model according to AIC score to predict survival and recapture probabilities.

RESULTS

Sparrow Density Surveys

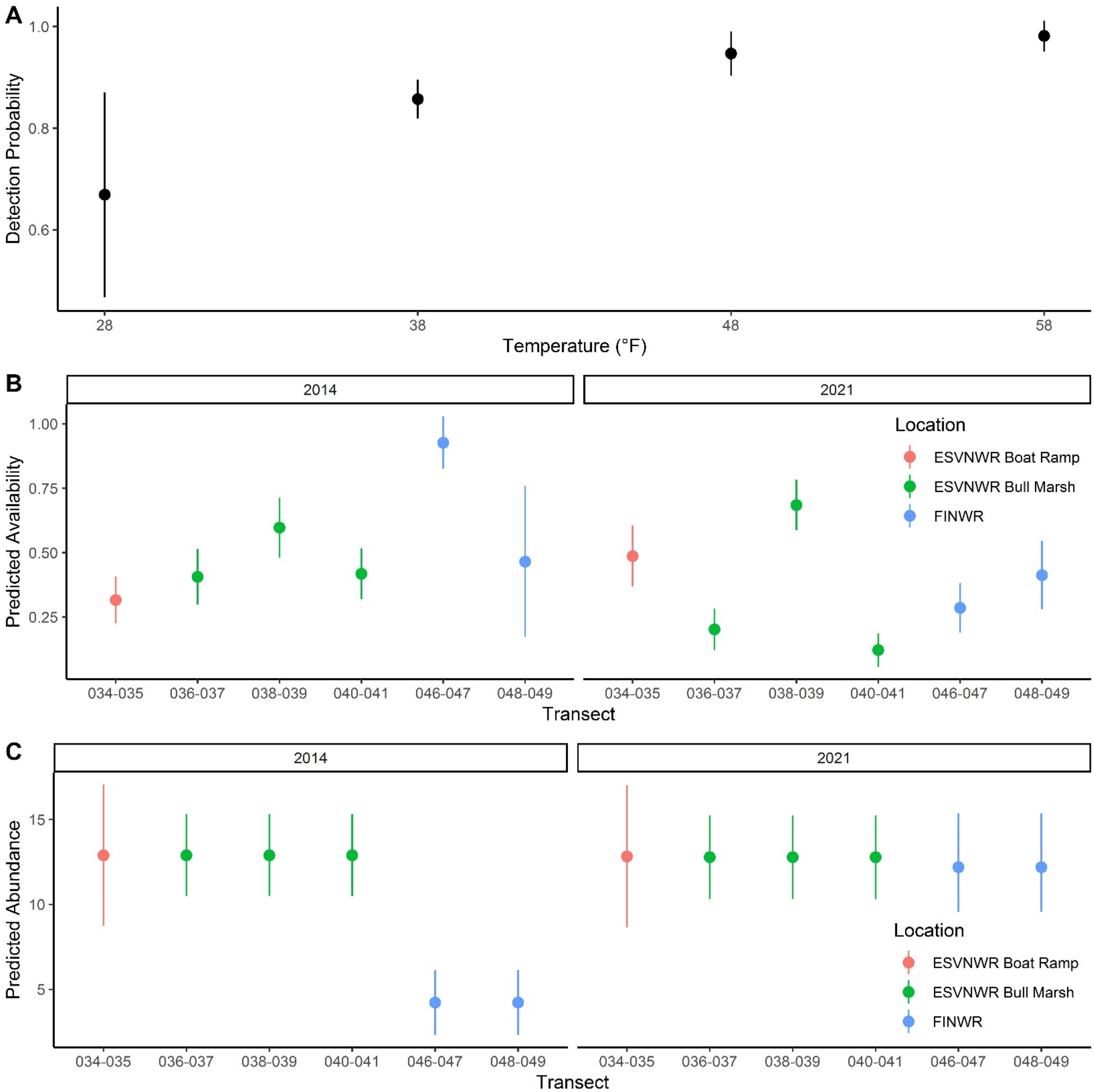
We observed a total of 81 Sharp-tailed Sparrows, 1 Seaside Sparrow, and 1 Marsh Wren over the course of the 2020-2021 field season. Total birds observed on transects decreased from 36 in period 1, to 24 in Period 2 and 23 in Period 3. The highest number of birds were observed during the first survey period, followed by period 2 and 3 (Table 1). Of the 83 birds detected, 70 were detected on the initial pass and 13 on the return pass.

The only environmental variable included in the detection function of our final model was daily low temperature and birds were more likely to be detected on days with a higher daily low temperature, though the error was much greater for the coldest days (Figure 4A). Detection on days with the mean daily low temperature (39® F) was 0.87 (±0.04). The only variables included within the availability function were transect identity, year, and an interaction between transect and year. Availability varied between years and among sites. Sparrows were most available at transect 046-047 on FINWR in 2021 and least available at transect 040-041 at Bull Marsh during the 2020-2021 season (Figure 4B). Abundance was relatively consistent among sites in 2021 (mean = 12.59, ±0.13), but was lower and not as consistent among sites during 2013-2014 (mean = 10.00, ±1.83, Figure 4C).

Table 1. Birds observed on transects during the 2013-2014 and 2020-2021 winters.

Species	Unit	Transect	2013-2014				2020-2021			
			Period 1	Period 2	Period 3	Total	Period 1	Period 2	Period 3	Total
STSP	ESVNWR Boat Ramp	034-035	0	3	8	**11**	5	9	4	**18**
	ESVNWR Bull Marsh	036-037	7	3	4	**14**	0	5	2	**7**
		038-039	6	9	5	**20**	14	5	9	**28**
		040-041	1	3	9	**13**	2	0	2	**4**
	FINWR	046-047	2	0	1	**3**	7	2	1	**10**
		048-049	2	0	0	**2**	7	2	5	**14**
SESP	FINWR	046-047	0	1	2	**3**	1	0	0	**1**
		048-049	0	2	0	**2**	0	0	0	**0**
MAWR	FINWR	046-047	0	1	1	**2**	0	1	0	**1**
Total			**18**	**22**	**30**	**70**	**36**	**24**	**23**	**83**

Figure 4. Plot depicting predicted Sharp-tailed Sparrow A) detection probability at ten degree increments between the lowest and highest daily low temperatures, B) predicted availability at all transects, and C) predicted abundance at all transects during the 2013-2014 and 2020-2021 winters. Error bars represent standard error.



Survival

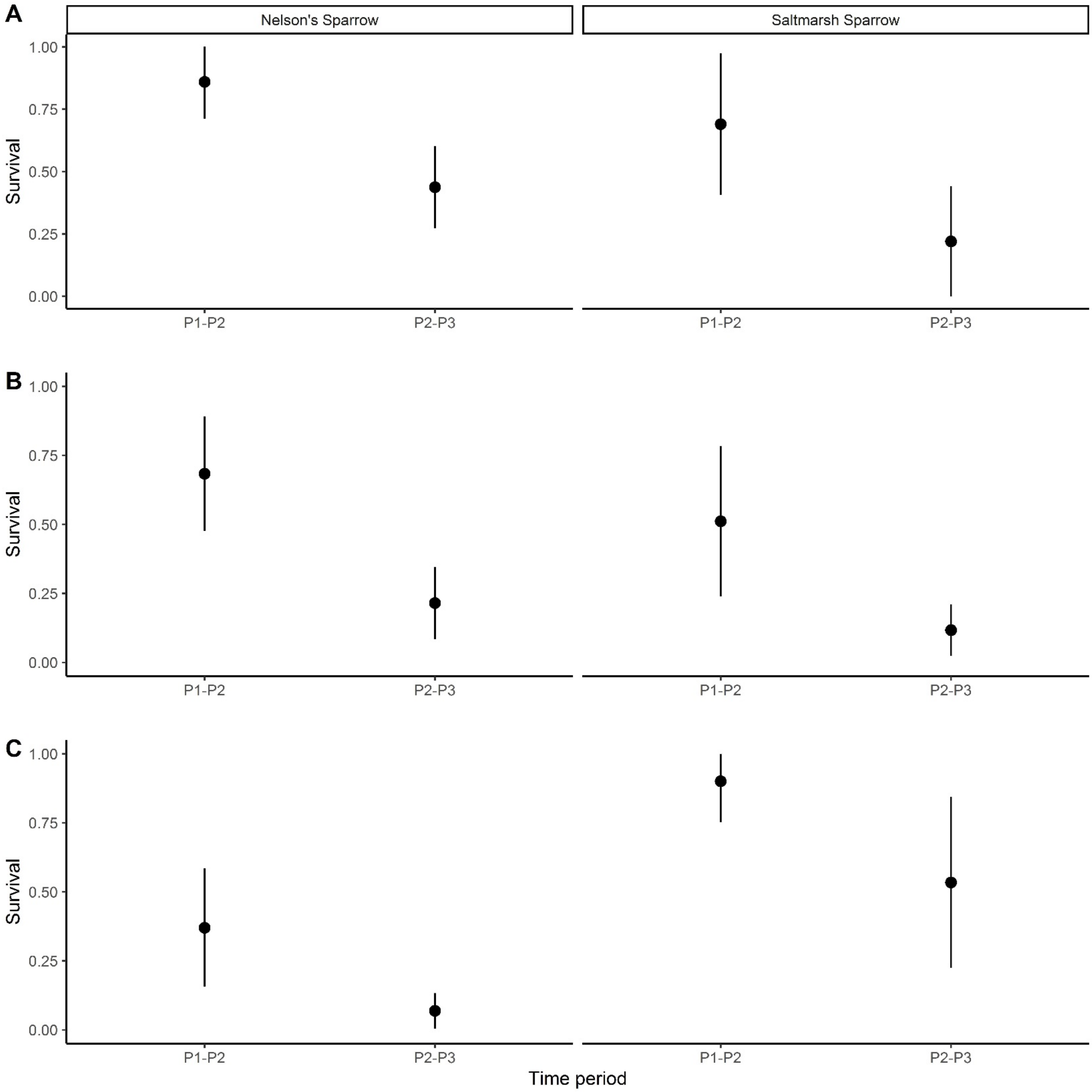
During the three capture periods we accumulated 42 Saltmarsh Sparrow captures, 91 Nelson's Sparrow captures, 3 Seaside Sparrow captures, and 1 Marsh Wren capture (Appendix I). Of those captured, 113 were newly banded, 1 bird was a foreign recapture, and 33 birds were within season recaptures. The number of birds captured during each period decreased (Table 2). Nelson's Sparrow captures outnumbered Saltmarsh Sparrows at all sites, though the ratio of Saltmarsh to Nelson's Sparrow captures was different between sites. Captures at the Boat Ramp location were most skewed towards Nelson's Sparrows (86.0% Nelson's Sparrows) followed by FINWR (64.9%) and Bull Marsh (57.6%). We captured one Saltmarsh Sparrow originally banded in New Hampshire as a nestling in 2021 and one Nelson's Sparrow was recaptured at Bull Marsh during capture period 2 after originally being captured and banded at the ESVNWR Boat Ramp during capture period 1.

Our top model included a time dependency, marsh location, species, and an interaction between marsh and species in the survival function with no predictors within the recapture probability function. Recapture probability for both Nelson's and Saltmarsh Sparrows was 0.56 (±0.14). Survival varied between marsh locations and species, but was greater for both species at all locations between the first and second capture periods (Figure 5). For Saltmarsh sparrows, survival declined from 0.51 (±0.27) between capture period 1 and capture period 2 to 0.12 (±0.09) between capture period 2 and capture period 3 at Bull Marsh, 0.69 (±0.28) to 0.22 (±0.22) at the ESVNWR boat ramp, and 0.90 (±0.14) to 0.53 (±0.31) at FINWR. For Nelson's Sparrows, survival declined from 0.51 (±0.27) between capture period 1 and capture period 2 to 0.12 (±0.09) between capture period 2 and capture period 3 at Bull Marsh, 0.69 (±0.28) to 0.22 (±0.22) at the ESVNWR boat ramp, and 0.90 (±0.14) to 0.53 (±0.31) at FINWR.

Table 2. Locations and total number of birds captured during the 2020-2021 winter.

Species	Unit	Period 1	Period 2	Period 3	Total
SALS	ESVNWR Boat Ramp	3	3	0	**6**
	ESVNWR Bull Marsh	7	12	4	**23**
	FINWR	3	6	4	**13**
NELS	ESVNWR Boat Ramp	18	10	9	**37**
	ESVNWR Bull Marsh	12	9	9	**30**
	FINWR	13	6	5	**24**
SESP	FINWR	1	2	0	**3**
MAWR	FINWR	1	0	0	**1**
Total		**58**	**48**	**31**	**137**

Figure 5. Plot depicting predicted Sharp-tailed Sparrow survival between capture period 1 (02 December – 04 December) and capture period 2 (13 January – 15 January) and between capture period 2 and capture period 3 (25 February – 27 February) at A) ESVNWR boat ramp , B) ESVNWR Bull Marsh, and C) FINWR. Error bars represent standard error.



Vegetation Characteristics

We found that the ocular estimates and stem counts were correlated ($\tau = 0.617$, $Z = 10.44$, $p < .001$) and exclusively used stem counts for all further analyses, though we do report ocular estimates for comparison to future studies (Table 3). *Spartina* stem counts did not differ between control and bird location plots ($W = 2624$, $p = 0.5849$). The number of seed heads with seeds available on control plots and bird observation plots did not differ during sampling period 2 ($X^2 = 0.0911$, df = 1, $p = 0.763$). There were differences in the number of seed heads that held seeds between periods ($X^2 = 15.121$, df = 2, p = < 0.001); seed heads that held seeds decreased from 4.97 per plot in Period 1, to 1.95 seeds per plot in Period 2, and to 0.35 seeds per plot in period 3.

Table 3. Mean stem counts, *spartina* cover, seed heads holding seeds, and height of tallest stem at vegetation plots during 2020-2021 winter vegetation sampling.

Location	Site	Survey Number	Sample Size	Mean Stems (± SE)	Mean Cover (± SE)	Mean Seeds (± SE)	Mean Height (± SE)
ESVNWR Boat Ramp	034-035	1	5	52.6 (±7.10)	56 (±4.85)	8.6 (±2.38)	76.2 (±7.48)
		2	9	56.33 (±6.90)	60 (±7.31)	1.22 (±0.46)	66.22 (±3.81)
		3	4	69.25 (±5.63)	67.5 (±9.46)	0	65.75 (±14.67)
		Control	10	48.7 (±4.02)	48 (±3.82)	1.5 (±0.54)	79.6 (±4.86)
ESVNWR Bull Marsh	036-037	1	0	NA	NA	NA	NA
		2	5	116 (±42.04)	61 (±11.98)	4.4 (±1.21)	57.8 (±5.35)
		3	2	102 (±31)	82.5 (±7.5)	1 (±1)	68 (±8)
		Control	10	78.5 (±6.38)	65.5 (±4.11)	4.8 (±1.50)	55.4 (±2.02)
	038-039	1	14	81.36 (±7.75)	74.29 (±3.81)	4.78 (±1.85)	64 (±3.54)
		2	5	74.4 (±5.64)	80 (±3.54)	0.8 (±0.37)	63.2 (±5.53)
		3	9	61.67 (±8.94)	65 (±7.99)	0.67 (±0.17)	61.33 (±5.30)
		Control	10	85 (±4.28)	80.5 (±3.45)	1.5 (±0.53)	56.6 (±2.68)
	040-041	1	2	146 (±2)	87.5 (±2.5)	0.5 (±0.5)	44.5 (±3.5)
		2	0	NA	NA	NA	NA
		3	2	54 (±8)	45 (±25)	0	54 (±3)
		Control	10	91.4 (±7.06)	75 (±6.01)	2.2 (±0.76)	53.8 (±2.30)
FINWR	046-047	1	8	67.38 (±7.19)	65.63 (±5.93)	2.63 (±1.21)	87.38 (±6.46)
		2	3	61.67 (±6.69)	73.33 (±9.28)	0.33 (±0.33)	87.33 (±5.21)
		3	1	70 (NA)	70 (NA)	0 (NA)	109 (NA)
		Control	10	50.2 (±4.72)	66.5 (±2.79)	1.4 (±0.62)	88.9 (±7.80)
	048-049	1	7	80.14 (±9.18)	65 (±7.56)	6.71 (±3.09)	82.71 (±6.59)
		2	2	64 (±7)	65 (±0)	0.5 (±0.5)	85.5 (±8.5)
		3	5	61 (±6.81)	67 (±7.84)	0	94.6 (±4.33)
		Control	10	57.1 (±2.87)	66 (±4.76)	1.4 (±0.77)	107.8 (±5.35)

DISCUSSION

Overall, Sharp-tailed Sparrow abundance was consistent between sites within the 2020-2021 survey window (Figure 4C). Our model attributed most of the difference in observations along transects to bird availability at individual transects rather than abundance of birds (Figure 4B). This suggests that birds are not distributed uniformly throughout the marsh, at least at low tide when we performed our surveys. However, neither seed head availability, vegetation height, nor stem density were different between control and bird location vegetation plots, possibly because birds are unable to target richer patches of resources, resources are distributed uniformly throughout the marsh, or because we are not measuring the appropriate resources that birds use during winter. We do believe *Spartina* is the base of these birds winter diet as previous work in North Carolina found that both Sharp-tailed Sparrow species primarily forage on C_4 plant matter, which would most likely be the dominant plant species in those marshes, *Spartina alterniflora*.

Seed head availability did differ between locations, but was fairly similar among transects at each location in control plots (Table 3) and seed availability was not a predictor included in our top abundance model. One potential explanation is that high tides may disperse seeds away from the plant that produced the seeds so that surveying seed heads does not accurately assess seed availability on the ground, at least at the scale of our vegetation plots. Wang et al. (2009) found that this is the case with *Scirpus* species in low marsh habitat. If most seeds disperse from their origin relatively soon after dissemination, seeds may accumulate in microtopographical highs or lows within the low marsh and sparrows may be able to locate potential seed hot spots.

Sparrow abundance was also consistent with surveys performed during the 2013-2014 winter except for one location, FINWR, where abundance was dramatically lower in 2013-2014 (Figure 4A). It is not clear what changes in the habitat at FINWR may have occurred between these two survey periods that may have effected increased bird abundance and it is not clear whether changes in wintering Saltmarsh or Nelson's Sparrows drove this discrepancy because no trapping occurred at the location in past seasons. Saltmarsh Sparrow survival was highest at this site while Nelson's Sparrow survival was lowest, so FINWR may be better suited to Saltmarsh Sparrows than it was in 2013-2014.

Apparent survival for Nelson's and Saltmarsh Sparrows has been reported at 0.48 – 0.67 in similar habitat in North Carolina (Winder et al. 2012). Overall, our results are in or near that range (Figure 5), but survival seems to vary throughout the winter at our site. Survival was dramatically lower between the second and third capture periods than between the first and second capture periods and approached zero for Nelson's Sparrows at FINWR. Cold weather and freezing precipitation can have dramatic effects on wintering marsh songbird mortality (Grant and Kirby-Smith 1992) and colder temperatures and precipitation that birds encountered during late January and early February may have influenced sparrow survival. Additionally, it is important to note that our mark-recapture model does not distinguish between mortality and permanent emigration so survival estimates should be considered minimums (Lebreton et al 1992). We did document one between-site movement that confirmed movement between marshes does occur at our study area, though we would expect a greater number of between site captures if movement between marshes was commonplace.

We found that nearly all seeds were removed from seed heads by the end of February (Table 3) and Nelson's Sparrows may have been affected to a greater degree at FINWR, where we failed to detect a single seed during our last survey period. However, Saltmarsh Sparrow survival was higher during the last period at FINWR than at either of the other two marsh locations, suggesting that the driver of survival may be slightly different for the two species of sharp-tailed sparrows.

Overall, our study revealed that bird abundance has remained relatively stable at two of the three marshes surveyed since the baseline 2014 study and increased at the only marsh to have exhibited a change in abundance (FINWR). Additionally, survival of the two sharp-tailed sparrows followed the same temporal trend within the 2020-2021 winter, though it was higher for Nelson's Sparrows at the marsh where we observed the highest capture ratio of that species (ESVNWR Boat Ramp) and highest for Saltmarsh sparrows at the marsh (FINWR) where the greatest change in abundance since the 2014 survey. These findings would generally indicate that current management practices are supporting the wintering populations at the study area, which is particularly important for Saltmarsh Sparrows given their precipitous decline in population.

Future Direction – We plan to continue surveying and capturing birds during the 2021-2022 winter at all three marsh locations to better understand annual changes in marsh use and survival. An additional year may also better reveal differences in apparent survival between transects within marsh systems (i.e., ESVNWR Boat Ramp, Bull Marsh, and FINWR), which would aid in making future management recommendations. We also plan to analyze feather tissue for DNA sex determination to elucidate whether sexual segregation occurs at these wintering locations.

ACKNOWLEDGMENTS

The 2020-2021 winter work was funded by U.S. Fish & Wildlife Service. Volunteers Andrew Rapp, Logan Anderson, and Sam Simon all contributed significant time and effort in support of this study. Additional support was provided by Pam Denmon and Meta Griffin. Erica Lawler provided contracting assistance from William & Mary.

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APPENDICES

Appendix I. Birds captured during winter 2020-2021 at the Eastern Shore of Virginia NWR and Fisherman Island NWR

Band Number	Species	Initial Capture	P1	P2	P3	Capture Location	Disposition
240113293	SALS	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113294	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113295	NESP	12/2/2020	1	1	1	Boat Ramp at ESVNWR	New Band
240113296	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113297	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113298	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113299	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
240113300	SALS	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070705	NESP	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070706	NESP	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070707	NESP	12/2/2020	1	1	1	Boat Ramp at ESVNWR	New Band
080070708	NESP	12/2/2020	1	0	1	Boat Ramp at ESVNWR	New Band
080070709	NESP	12/2/2020	1	0	1	Boat Ramp at ESVNWR	New Band
080070710	SALS	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070711	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
080070712	NESP	12/2/2020	1	0	1	Boat Ramp at ESVNWR	New Band
080070713	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
080070714	NESP	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070715	NESP	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070716	NESP	12/2/2020	1	0	0	Boat Ramp at ESVNWR	New Band
080070717	NESP	12/2/2020	1	1	0	Boat Ramp at ESVNWR	New Band
080070718	NESP	12/2/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070719	SALS	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070720	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070721	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070722	NESP	12/3/2020	1	1	1	Bull Marsh at ESVNWR	New Band
080070723	NESP	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070724	SALS	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070725	SALS	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070726	NESP	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070727	SALS	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070728	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070729	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070730	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band

Band Number	Species	Initial Capture	P1	P2	P3	Capture Location	Disposition
080070731	SALS	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070732	SALS	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070733	SALS	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070734	NESP	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070735	NESP	12/3/2020	1	1	0	Bull Marsh at ESVNWR	New Band
080070736	NESP	12/3/2020	1	0	0	Bull Marsh at ESVNWR	New Band
080070737	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070738	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070739	NESP	12/4/2020	1	1	0	Fisherman Island NWR	New Band
080070740	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070741	SALS	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070742	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070743	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070744	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070745	SALS	12/4/2020	1	1	0	Fisherman Island NWR	New Band
080070746	SALS	12/4/2020	1	1	1	Fisherman Island NWR	New Band
080070747	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070749	NESP	12/4/2020	1	1	1	Fisherman Island NWR	New Band
080070750	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070751	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070752	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070753	NESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
080070754	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070755	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070756	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070757	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070758	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070759	NESP	1/13/2021	0	1	1	Boat Ramp at ESVNWR	New Band
080070760	SALS	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070762	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070763	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070764	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070765	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070766	NESP	1/13/2021	0	1	0	Boat Ramp at ESVNWR	New Band
080070767	NESP	1/13/2021	0	1	1	Boat Ramp at ESVNWR	New Band
080070768	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070769	SALS	1/14/2021	0	1	1	Bull Marsh at ESVNWR	New Band
080070770	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070771	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band

Band Number	Species	Initial Capture	P1	P2	P3	Capture Location	Disposition
080070772	NESP	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070773	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070774	NESP	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070775	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070776	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070777	NESP	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070778	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070779	NESP	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070780	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	New Band
080070781	SALS	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070782	NESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070783	NESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070785	SALS	1/15/2021	0	1	1	Fisherman Island NWR	New Band
080070786	NESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070787	SALS	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070788	NESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070789	SALS	1/15/2021	0	1	0	Fisherman Island NWR	New Band
080070790	NESP	2/25/2021	0	0	1	Boat Ramp at ESVNWR	New Band
080070791	NESP	2/25/2021	0	0	1	Boat Ramp at ESVNWR	New Band
080070792	SALS	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070793	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070794	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070795	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070796	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070797	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070798	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070799	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
080070800	SALS	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
204010048	NESP	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
204010049	SALS	2/26/2021	0	0	1	Bull Marsh at ESVNWR	New Band
204010050	NESP	2/27/2021	0	0	1	Fisherman Island NWR	New Band
204010051	NESP	2/27/2021	0	0	1	Fisherman Island NWR	New Band
204010052	NESP	2/27/2021	0	0	1	Fisherman Island NWR	New Band
204010053	NESP	2/27/2021	0	0	1	Fisherman Island NWR	New Band
204010054	SALS	2/27/2021	0	0	1	Fisherman Island NWR	New Band
204010055	SALS	2/27/2021	0	0	1	Fisherman Island NWR	New Band
244164230	SESP	12/4/2020	1	0	0	Fisherman Island NWR	New Band
244164231	SESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band
244164232	SESP	1/15/2021	0	1	0	Fisherman Island NWR	New Band

Band Number	Species	Initial Capture	P1	P2	P3	Capture Location	Disposition
265068174	MAWR	12/4/2020	1	0	0	Fisherman Island NWR	New Band
281138486	SALS	1/14/2021	0	1	0	Bull Marsh at ESVNWR	Foreign Recapture