2020

Winter distribution and migration ecology of the Ipswich Sparrow in the mid-Atlantic: Year 2020 report.

Chance Hines
William & Mary

Bryan D. Watts
William & Mary

Laura Duval
William & Mary

Recommended Citation

Hines, C. H., L. S. Duval, and B. D. Watts. 2020. Winter distribution and migration ecology of the Ipswich Sparrow in the mid-Atlantic: Year 2020 report. Center for Conservation Biology Technical Report Series, CCBTR-20-06. William & Mary, Williamsburg, VA. 8 pp.

WINTER DISTRIBUTION AND MIGRATION ECOLOGY OF THE IPSWICH SPARROW IN THE MID-ATLANTIC
YEAR 2020 REPORT

THE CENTER FOR CONSERVATION BIOLOGY

WILLIAM & MARY

Winter Distribution and Migration Ecology of the Ipswich Sparrow in the mid-Atlantic
Year 2020 Report

Chance Hines
Laura Duval
Bryan Watts
The Center for Conservation Biology
William & Mary

Recommended Citation:

Hines, C. H., L. S. Duval, and B. D. Watts. 2020. Winter distribution and migration ecology of the Ipswich Sparrow in the mid-Atlantic: Year 2020 report. Center for Conservation Biology Technical Report Series, CCBTR-20-06. William & Mary, Williamsburg, VA. 8 pp.

Project Partners:

National Park Service
United States Fish and Wildlife Service
Delaware State Parks
Delaware Department of Natural Resources Division of Fish & Wildlife
Maryland Department of Natural Resources
North Carolina Wildlife Resources Commission
Virginia Department of Game and Inland Fisheries
United States Coast Guard
Dalhousie University
Acadia University
The Center for Conservation Biology
William & Mary

Front Cover: Ipswich Sparrow perched on beach grass at Cape Henlopen State Park in December 2019. Photo by Chance Hines.

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.

Table of Contents

Contents

EXECUTIVE SUMMARY

The wintering and migratory periods are the most poorly understood period of a songbirds' life, yet these periods also account for significant mortality. A lack of information about these periods hampers our ability to conserve habitats that support birds and mitigate mortality. Understanding the factors that limit and regulate survival during these periods requires an understanding of both non-breeding behaviour and demography. In an effort to better understand the factors that influence Ipswich sparrow winter ecology, we have implemented a mark-recapture program to quantify survivorship, established distance sampling transects to understand what parameters influence density, and tracked birds using radio-telemetry to better understand habitat use.

During the winter of 2019-2020, we detected 19 Ipswich sparrows along 29 total km of habitat. We did not detect Ipswich sparrows along eight transects that were north of Delaware. Within the wintering range of North Carolina to Delaware we found sparrow abundance was positively associated with the number of grass and forb occurrences at vegetation plots.

We captured 132 birds including 125 unbanded birds, 6 birds that we initially banded during the 2018-2019 winter, and 1 bird that we initially captured during the 2017-2018 winter. In addition to captured birds, we resighted 15 additional birds banded in 2018-2019 winter and 3 additional birds that we banded during the 2017-2018 winter. We found recapture probability to be 0.41 (SE ± 0.11) and winter survival to be 0.76 (SE ± 0.13).

We also applied nanotags to 30 birds during late November 2019 and tracked these birds until mid-February 2020. The vast majority of detections occurred in dune habitats including: 366 in hind dune and 225 in the fore dune. Detections in atypical habitats included 26 in shrubs/trees behind the dunes, 10 in marsh habitats, and 3 on the open beach. We collected >5 locations on 25 of the 30 radio-tagged individuals. Of these 25 birds, 2 of them did not maintain a single home territory and "floated" from one temporary territory to another throughout the field season. The remaining 23 birds had a home range of 4.99 ha (SE ± 1.10).

BACKGROUND

Ipswich sparrows spend their lives on the wild edge where the Atlantic Ocean meets land. The entire population breeds on one small sandy island off the coast of Canada and they migrate and winter through similar coastal habitat. These sparrows have evolved in this constantly changing environment, their plumage blending in perfectly with the open sand and tones of mid-winter vegetation. This species, listed as a species of Special Concern in Canada and a variety of levels in the USA (COSEWIC 2009), is subject to numerous anthropogenic threats (Nickerson et al. 2007, Longcore & Smith 2013) and severe weather (Huang et al. 2017) along its known non-breeding range. The dunes in which Ipswich sparrows spend their winters are susceptible to high-intensity nor'easters that strip seeds from plants and flatten or rearrange entire swaths of habitat. Heavy snowstorms on the outer coast can bury most of the available seed crop. Severe cold temperatures on the northern end of their winter range likely cause some degree of facultative migration to warmer climes. Still, these birds persist, and the degree to which they have adapted to this harsh environment is nothing short of amazing.

There are few populations of songbirds that can be comprehensively studied during all phases of their life history, and because of this, the Ipswich sparrow is an ideal model species for studying both the factors that affect migratory behavior and demography. First, wintering grounds are restricted to coastal dune habitat along the eastern seaboard from Nova Scotia (NS), Canada to Florida, USA (Stobo & McLaren 1971), which limits the scope of migratory movements. Second, sparrows breed exclusively on Sable Island, NS, an isolated sandspit 300 km east of mainland NS (Stobo & McLaren 1971), meaning the end of spring migration is clearly demarcated and all birds arriving on-island can be documented. Third, this breeding on an isolated island means there is no immigration or emigration from the population, which provides a unique study system where true, rather than apparent survival, may be determined.

This research adds to our knowledge of how demographic parameters in a songbird interact and influence population dynamics in this species. As such, this understanding contributes to the global knowledge of population dynamics of songbird species. Pinpointing demographic limitations will improve management efforts throughout the range of Ipswich Sparrows, allow us to anticipate how population size may respond to altered environmental conditions, allow conservation strategies to be tailored to the specific needs of sparrows, and provide insight into mitigating any future declines. This is especially important given the susceptibility of migratory species to change (Shaw 2016).

OBJECTIVES

The overarching goals of this project are to:

1) Evaluate migratory patterns of habitat corridors that Ipswich Sparrows use during winter.

2) Quantify the temporal and spatial attributes of spring migration in the Ipswich Sparrow by age and sex cohorts.

3) Determine survival of Ipswich Sparrows during breeding, spring migration, wintering, and fall migration by age cohorts.

After the first year of the study, we established that Ipswich sparrow abundance was greatest in undeveloped dune habitats. After year two, we found that raw counts of sparrow abundance were positively associated with vegetation cover (particularly the forbs *Diodella teres, Oenothera deltoids*, and *Solidago sempervirens*) in dune habitats. During our third year of research, we expanded on our distance sampling efforts north to Massachusetts. We continued our mark-recapture efforts at our dedicated sites, but we also applied 30 nanotags and tracked birds throughout the winter to understand habitat use and home range dynamics.

METHODS

Line Transect Surveys

Observers walked 1 km transects along dune habitat searching for sparrows. When a sparrow was located, the observer took a GPS location, collected distance (m) to bird (with a digital rangefinder), and estimated the displacement angle of the bird from the transect line (with a compass). We also quantified vegetation along transects by counting and identifying all stems to species in 20 randomly generated 0.52 m^2 circular plots. We calculated density using the package 'unmarked' in program R. We included wind (on the Beaufort scale) and temperature (C®) as parameters in the detection function. We included year, the number of vegetation plots where *Ammophila breviligulata* was present, and number of vegetation plots where forbs that were identified as important in 2019 were present (*Diodella teres, Oenothera deltoids*, or *Solidago sempervirens)*, as parameters in the density function.

Survival

Sparrows were captured using portable mist nets that were set up and taken down to target specific birds within trapping sites. Once captured, we banded sparrows with a standard USGS tarsal band and a unique combination of color bands. Morphometric measurements that were 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 a small blood sample to analyze for sex determination.

For survival analyses, we limited our dataset to birds captured or resighted during three capture windows throughout the 2018-2019 and 2019-2020 winters. During these capture events, we searched dune habitat at 8 locations (Table 1). We calculated apparent survival and recapture probability using the package 'marked' in program R.

Radio-telemetry

We attached 0.68 g coded nanotags to a subset of birds via leg-loop harness (Rappole & Tipton 1991) and tracked them from 29 Nov 2019-31 Jan 2020 3-5 times/week. We did not affix transmitters to any bird captured within 350 m of another radio-tagged bird's capture location. The tracking procedure began by identifying a unique bird using an omni-directional antenna attached to our vehicle. From there, we used a hand-held yagi to hone in on the bird's location. Once a bird was located and identified, we recorded habitat type and the coordinates at the bird's location. To calculate home range size, we constructed 95% minimum convex polygons (MCP) using the package 'sp' in program R.

RESULTS

Line Transect Surveys

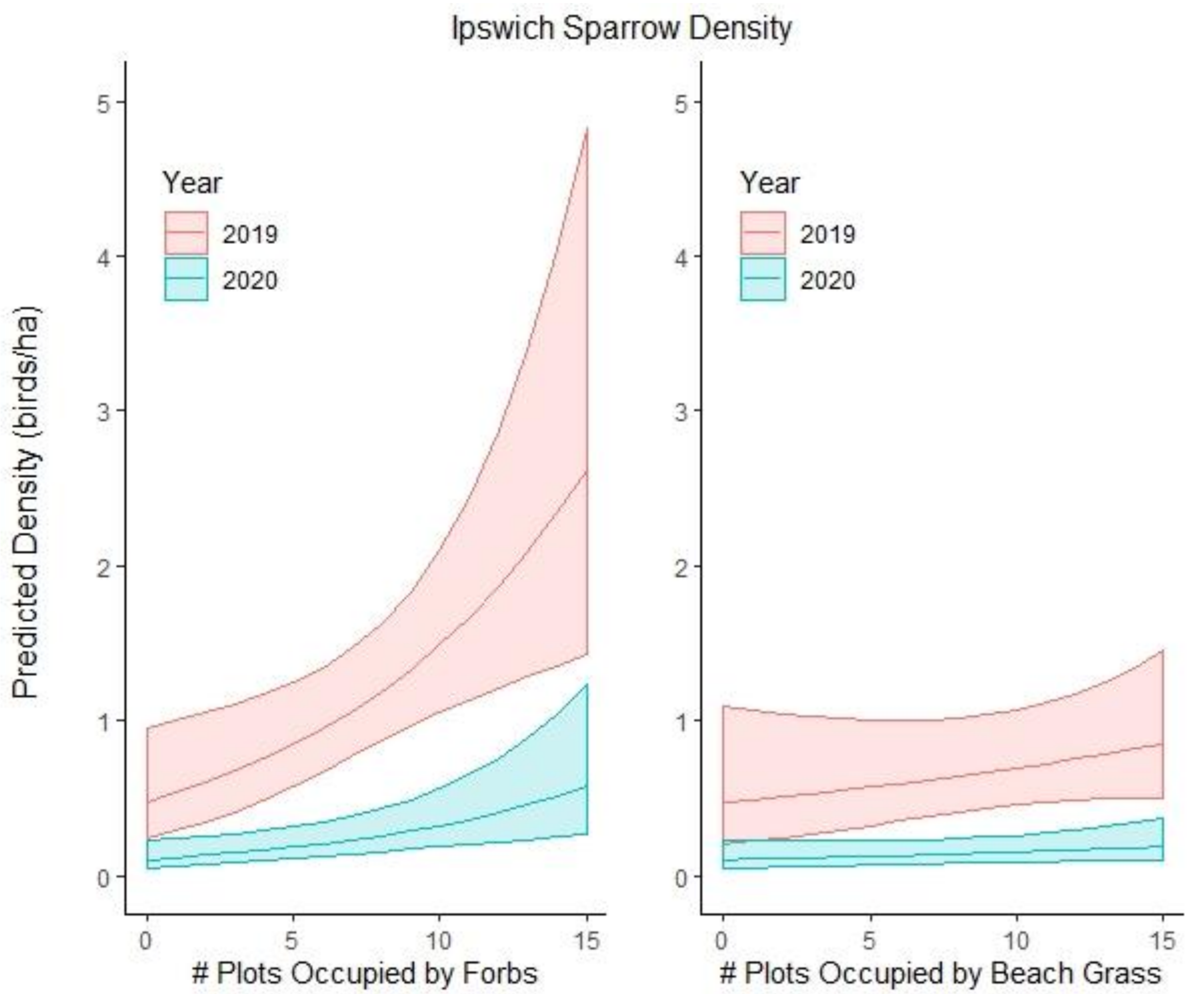
We observed 19 Ipswich Sparrows along 29 total km of transects from North Carolina to Massachusetts (Table 1). We observed zero birds along 8 km of transects north of Delaware so we excluded this region from further analyses. From North Carolina to Delaware, we recorded fewer observations per km than in past years (0.9 in 2020 vs 5.4 in 2019). Generally, sparrow abundance was positively associated with the number of grass and forb occurrences at vegetation plots, though the effect size associated with forb occurrence (.11, SE ± 0.04) was greater than that of grass occurrence (0.04, SE ± 0.04) (Figure 1).

Table 1. Distance sampling transects with number of vegetation plots where beach grass (*Ammophila breviligulata*) was present, number of veg plots where forbs (*Diodella teres, Oenothera deltoids*, or *Solidago sempervirens*) were present, and number of birds observed on Distance sampling transects. Transects are ordered from south to north.

State	Location	Transect	Plots with Beach Grass	Plots with Forbs	# Birds Observed
North Carolina	Cape Hatteras NS	North Carolina 01	3	2	0
		North Carolina 02	0	7	0
		North Carolina 03	5	1	0
		NSD 03	1	0	0
		NSD 02	0	0	2
		NSD 01	2	6	0
		NSD 04	5	5	0
	Currituck County	NUD 13	4	5	0
Virginia	Grandview Preserve	Grandview	16	9	0
	Chincoteague NWR	Toms Cove	13	9	4
		Wild Beach	11	12	2
Maryland	Assateague NS	NUD 07	6	1	1
		NUD 08	11	4	3
Delaware	Fenwick SP	NUD 10	14	3	1
	Delaware Seashores SP	North Inlet	16	12	4
		Conquest	16	5	0
	Cape Henlopen SP	Cape Henlopen	12	7	1
	Prime Hook NWR	Prime Hook 01	15	1	0
		Prime Hook 02	18	2	0
		Prime Hook 03	12	10	0
		Prime Hook 04	12	2	1

State	Location	Transect	Plots with Beach Grass	Plots with Forbs	# Birds Observed
New York	Fire Island NS	Fire Island 03	17	1	0
		Fire Island 04	20	0	0
		Fire Island 05	16	0	0
		Fire Island 06	17	0	0
Massachusetts	Cape Cod NS	Cape Cod 10	19	3	0
		Cape Cod 08	8	1	0
		Cape Cod 06	17	1	0
		Cape Cod 04	20	1	0

Figure 1. Plot depicting predicted Ipswich sparrow density along transects in relation to A). year and number of vegetation plots occupied by forbs (*Diodella teres, Oenothera deltoids*, or *Solidago sempervirens*) or B.) year and number of vegetation plots occupied by beach grass(*Ammophila breviligulata*). The solid center lines represent predicted densities and the shaded areas represent 95% confidence limits



Survival

We captured Ipswich sparrows during three periods from 18 Nov 2019 to 11 Mar 2020. We captured 132 birds including 125 unbanded birds, 6 birds that we initially banded during the 2018-2019 winter, and 1 bird that we initially captured during the 2017-2018 winter (Table 2). We also resighted 15 additional birds banded in 2018-2019 winter and 3 additional birds that we banded during the 2017-2018 winter. We found recapture probability to be 0.41 (SE ± 0.11) and winter survival to be 0.76 (SE ± 0.13).

Table 2. Locations and total number of captured Ipswich sparrows in 2019 and 2020.

State	Location	2019 Captures	2020 Captures
North Carolina	Cape Hatteras NS	30	7
	Currituck NWR	13	1
Virginia	Chincoteague NWR	41	32
	Grandview Island	30	11
Maryland	Assateague NS	69	36
Delaware	Cape Henlopen SP	26	43
	Delaware Seashores SP	5	-
	Prime Hook NWR	-	2

Radio-telemetry

We applied tags to 30 birds on Assateague Island and collected 630 locations throughout the field season. The vast majority of these detections occurred in dune habitats including: 366 in hind dune, 225 in the fore dune. Detections in atypical habitats included 26 in shrubs/trees behind the dunes, 10 in marsh habitats, and 3 on the open beach. We collected >5 locations on 25 of the 30 radio-tagged individuals. Of these 25 birds, 2 of them did not maintain a single home territory and "floated" from one temporary territory to another throughout the field season. The remaining 23 birds had a 95% MCP of 4.99 ha (SE ± 1.10). There were two confirmed and two suspected predations. Fifteen of the 30 birds were still present on the island at of the end of the tracking period. Only one of the missing birds was reported by operators of Motus towers during or after the field season. This bird passed back through Assateague Island heading north and was detected by the Buntings tower at midnight and then again at 0008 at the Assateague Island State Park tower.

DISCUSSION

Overall, Ipswich sparrow density and captures along mark-recapture plots were both lower in 2020 than in 2019 (Tables 1 and 2). The lower density of birds was particularly noticeable in the southern portion of their range (i.e., North Carolina) where total captures declined by 75% and birds per transect declined by 95%. Year-to-year fluctuations in Ipswich sparrow populations have been documented in the past (COSEWIC 2009). Stobo and Maclaren conducted the initial winter range surveys in the early 1970s and concluded the Outer Banks were uninhabited by Ipswich Sparrows in winter; they also conducted their surveys during a period when Ipswich sparrow populations were relatively low (Stobo and McLaren 1971, COSEWIC 2000). Their results in conjunction with the fact that densities in North Carolina were similar to the Delmarva Peninsula in 2019, but were drastically lower in 2020, suggests that these more southern areas act as auxiliary winter range when the population climbs above a certain threshold. Areas we surveyed north of Delaware were certainly not part of the primary winter range in 2020, but may also be auxiliary range when the population is larger.

Colder temperatures may explain why we found zero birds at our northern most survey locations, but it seems unlikely that the colder winter is the lone reason explaining the scarcity of birds given that a small portion of the population manages to survive the winter without migrating from Sable Island. The scarcity of birds in New England and North Carolina may be explained by dune plant-community composition. We frequently observed sparrows foraging on *S. sempervirens* florets throughout the three years of this study, while sparrow tracks often led to *D. teres* and *O. deltoids,* which provide seeds throughout the winter. We would also frequently observe sparrows foraging on *A. breviligulata* seed heads where available. All of these plant species were commonly identified at vegetation plots from Virginia to Delaware (Table 1), but either grasses or the appropriate forbs were absent outside of this region. At our northern most sites, forbs were scarce, but *A. breviligulata* was abundant. At our southern sites, forbs were more abundant but *A. breviligulata* was scarce (Table 1). It appears that Ipswich sparrows prefer undisturbed dunes where preferred grasses and forbs are both available. These plants often were associated with mature dunes, though *A. breviligulata* was planted along transects that occurred in younger dunes established after Hurricane Sandy. This species is typically planted with the goal of stabilizing dunes (Charbonneau 2019), but also benefits wildlife like Ipswich Sparrows. For future planning, we recommend planting forbs like *S. sempervirens*, *D. teres* and *O. deltoids* that would further enhance habitat quality for dune-obligate seed foragers like Ipswich sparrows.

Future Direction – We are currently working with collaborators to integrate the information that we have collected throughout this species wintering range, migratory data from the motus network, and fecundity data from Sable Island to develop an integrated population model. A funding source for 2020-2021 winter work has not been identified, but we would like to continue to survey our long-term line transect sites and revisit our capture-recapture sites to better understand how winter dynamics can influence population trends for a dune obligate bird species. We would also like to better understand how beach plantings influence habitat quality and subsequent sparrow use by expanding some these activities to a greater number of areas where these management activities occur.

ACKNOWLEDGMENTS

The 2019-2020 winter work was conducted with the help of many partners, land managers, and funding agencies, including the National Park Service, U.S. Fish & Wildlife Service, Dalhousie University, Acadia University, Delaware State Parks (Cape Henlopen, Delaware Seashore, and Fenwick Island), Delaware Department of Natural Resources Division of Fish & Wildlife, Virginia Department of Conservation and Recreation, The Nature Conservancy, Maryland Department of Natural Resources, Virginia Department of Game and Inland Fisheries, the North Carolina National Estuarine Research Reserve, and the North Carolina Wildlife Resources Commission. Amy Whitear, Becky Jardin, Dave Brinker, Nick Newberry, Courtney Check, Aylett Lipford, and Emily Snyder all contributed significant time and effort in support of this study. Dave Brinker was particularly helpful with setting up additional Motus towers to assist tracking birds.

LITERATURE CITED

Charbonneau, B.R., Cochran, C. and Avenarius, C., 2019. What we know and what we think we know: Revealing misconceptions about coastal management for sandy beaches along the US Atlantic Seaboard. Journal of environmental management, 245:131-142.

COSEWIC. 2009. COSEWIC assessment and update status report on the Savannah Sparrow princeps subspecies Passerculus sandwichensis princeps in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 13 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Huang, Q., Sauer, J.R. and Dubayah, R.O., 2017. Multidirectional abundance shifts among North American birds and the relative influence of multifaceted climate factors. Global change biology, 23:3610-3622.

Longcore, T. and Smith, P., 2013. On avian mortality associated with human activities. Avian Conservation and Ecology, 8.

Nickerson, C., 2007. Mighty vulture back from near extinction. Vulture News, 56:104-105.

Runge, C.A., Martin, T.G., Possingham, H.P., Willis, S.G. and Fuller, R.A., 2014. Conserving mobile species. Frontiers in Ecology and the Environment, 12(7), pp.395-402.

Shaw, A.K., 2016. Drivers of animal migration and implications in changing environments. Evolutionary Ecology, 30:991-1007.

Stobo, W.T., and McLaren, I.A. 1971. Late-winter distribution of the Ipswich Sparrow. American Birds, 25: 941–944.