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Timothy Brush

Hugh E. Conway

Catherine C. Brush

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HABITAT USE AND WINTER SITE FIDELITY OF LINCOLN'S SPARROW (*MELOSPIZA LINCOLNII*) IN THE LOWER RIO GRANDE VALLEY OF TEXAS

Timothy Brush<sup>1\*</sup>, Mark H. Conway<sup>2</sup>, and Catherine C. Brush<sup>3</sup>

<sup>1</sup>Department of Biology, University of Texas Rio Grande Valley, Edinburg, TX 78539

<sup>2</sup>Rio Grande Avian Research, 2106 Emerald Lake Drive, Harlingen, TX 78550

<sup>3</sup>900 McKee Drive, Edinburg, TX 78539

\*Corresponding author; Email: [timothy.brush@utrgv.edu](mailto:timothy.brush@utrgv.edu)

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Lincoln's sparrow (*Melospiza lincolnii*) is a common wintering bird species across the southern USA, Mexico, and northern Central America. Unlike many migratory sparrows, which are grassland or savannah species, Lincoln's sparrow occurs mainly in brushy forest edge, weedy fields, and wetland edges (Lockwood & Freeman 2014, Ammon 2020). This sparrow is a common to abundant winter resident in the Lower Rio Grande Valley of Texas (Oberholser 1974, McKinney 2002), but little is known of winter habitat use, including annual variation in numbers and site fidelity to wintering locations. Winter site fidelity can enhance the likelihood of surviving a difficult season, as individuals are familiar with locations of predators and food sources (Sandercock & Jaramillo 2002), but unpredictable conditions may discourage site fidelity (Greenberg et al. 2010). Previous studies have documented population variability in Texas (Slifka 2021) and fairly high between winter site fidelity in California (Sandercock & Jaramillo 2002).

Given the difficulty of accurately counting Lincoln's sparrows in dense scrub habitats, we banded birds to determine winter population size, as well as to study site fidelity directly. We used the number of birds banded per winter as our indicator of population size, and we used the number of recaptured birds to measure site fidelity, both short-term (within a given winter) and long-term (between different winters). We correlated precipitation during the previous late summer-fall rainy period with the number of birds banded and frequency of recaptures.

*Study sites and methods.*—We banded all birds under permits SPR-0703-14 (Texas) and 22758 (federal) issued to MHC as permittee and

CCB as sub-permittee. For the winters of 2014–2015 through 2021–2022, our main study period, CCB banded Lincoln's sparrows at Brushwood South (BWSO), a 4.4 ha tract of open thornscrub, located at 26.373° N, 98.198° W in Hidalgo County, Texas. During the same period, MHC banded at a 14 ha site within the Arroyo Colorado unit of Las Palomas Wildlife Management area (ARUN), a 318 ha tract of mixed thornscrub and woodland, located at 26.317° N, 97.524° W along the Arroyo Colorado waterway in Cameron County. ARUN is 67 km east of BWSO. MHC also banded Lincoln's sparrows at ARUN during 2004–2005 through 2013–2014. BWSO is surrounded by a mixture of irrigated agricultural fields, rural residences, and some small patches of thornscrub, while the ARUN banding station is surrounded mainly by small wetlands, thorn forest, deciduous floodplain forest, and extensive agricultural fields. The ground cover at both locations was a mixture of native and non-native plants, in particular Guinea grass (*Megathyrsus maximus*).

We opportunistically banded Lincoln's sparrows at both sites, as banding was done for general purposes. We maintained a small feeding station at BWSO, to help attract birds for banding, while ARUN had a deer feeder in the western section of the banding area. The banding effort was over 4 times greater at ARUN than BWSO. During the 2014–2015 through 2021–2022 period, net hours per winter season varied from 67.0–267.25 at BWSO (total=1414.75), and 531.5–992.0 (total=6058.25) at ARUN. Net-hours ranged from 431.06–1044.75 (total=7971.81) at ARUN during the 2004–2005 through 2013–2014 period.

Because winter-season grass productivity seems controlled mainly by precipitation during the second half of the year (TB, pers. obs.), we obtained July–December precipitation values from the McAllen and Harlingen airports. July–December precipitation varied from 223.3–613.2 mm (avg.=388.6 mm) at Harlingen Airport, and 141.5–461.3 mm, (avg.=312.2 mm) at McAllen Airport. Often the bulk of the precipitation would fall within one or two months, with most months being quite dry. Overall seasonal precipitation at the two sites was correlated ( $r=0.528$ ,  $n=8$ ).

*Results.*—The number of Lincoln’s sparrows we captured per year varied widely (Table 1). During the winters of 2014–2015 through 2021–2022, the numbers of birds banded per winter varied from zero to 29 (avg.=13.5) at BWSO and from four to 36 (avg.=12.0) at ARUN. This resulted in 7.49 birds/100 net-hours at BWSO and 1.57 birds/100 net-hours at ARUN. Additionally, we banded 95 Lincoln’s sparrows at ARUN during winters 2004–2005 through 2013–2014, resulting in 1.19 birds/100 net-hours during this period. During our main study period, seasonal precipitation during July–December was weakly correlated with the winter’s birds/net-hour at ARUN (Pearson’s  $r=0.128$ ) and BWSO (Pearson’s  $r=0.404$ ). Overall, seasons with less than 250 mm of rainfall had small numbers of birds, but years with precipitation above 250 mm showed much variation in birds banded (Table 2).

During the main 2014–2015 to 2021–2022 study period, we recaptured 25.7% of the 106 birds banded at BWSO and 22.1% of the 95 birds banded at ARUN. At BWSO, 21 birds were recaptured within the same winter in which they were banded; 16 more than one month after being banded and the remaining five only within the month in which they were banded. Three of the BWSO birds were captured more than once in the same winter in which they were banded: individual 1661-23117 was banded on 9 Feb 2017 and recaptured there on 23 Feb and 25 Mar 2017; 1661-23173 was banded on 23 Feb 2019 and recaptured there 14 Mar 2019 and 19 Apr 2019; and 2741-24570 was

Table 1. Numbers of Lincoln’s sparrows banded at study sites in the Lower Rio Grande Valley of Texas, Oct–Apr 2014–2015 through 2021–2022 (ARUN = Arroyo Colorado Unit of Las Palomas Wildlife Management Area; BWSO = Brushwood South).

Year	ARUN	BWSO
2014-2015	9	19
2015-2016	4	12
2016-2017	15	9
2017-2018	7	10
2018-2019	36	29
2019-2020	3	0
2020-2021	13	26
2021-2022	5	1
Total	95	106

Table 2. Numbers of Lincoln's sparrows banded per 100 net-hours at Arroyo Colorado Unit of Las Palomas Wildlife Management Area (ARUN) and Brushwood South (BWSO) with seasonal precipitation (mm) at airports closest to the study sites (Harlingen Airport for ARUN; McAllen Airport for BWSO).

	Birds/100 net-hours		Precipitation	
	BWSO	ARUN	McAllen Airport	Harlingen Airport
2014-2015	17.312	1.951	461.3	520.5
2015-2016	17.910	0.556	304.3	469.6
2016-2017	3.900	1.512	141.5	243.1
2017-2018	3.742	0.878	348.0	291.9
2018-2019	12.636	3.636	263.1	509.3
2019-2020	0	1.129	194.1	231.4
2020-2021	14.000	1.744	380.0	223.3
2021-2022	0.585	0.707	405.1	613.2

banded on 14 Jan 2019 and recaptured there on 23 Feb and 14 Mar 2019. At ARUN, 31 birds were recaptured within the same winter in which they were banded; 11 more than one month later, and the remaining 20 only within the month in which they were banded. Two of the ARUN birds were recaptured more than once in the same winter in which they were banded: 0920-82634 was banded on 26 Feb 2017, and recaptured there on 2 and 8 Apr 2017, and 0920-82940 was banded on 16 Feb 2019 and recaptured there on 14 and 20 Apr 2019. 12.6% of the birds banded at ARUN from 2004–2005 through 2013–2014 were recaptured at least once.

Eight (4%) of the 201 Lincoln's sparrows banded during the main study period showed site fidelity between winters: three of the 106 birds (2.8%) banded at BWSO, and five of the 95 birds (5.3%) at ARUN were recaptured in a different winter than the one in which they were banded. Most noteworthy was 0920-82833, which was banded at ARUN on 25 Apr 2018 and recaptured there three winter seasons later, on 25 Apr 2021. The other seven were recaptured in the winter immediately following the one in which they were banded. Individual 1661-23106 was banded at BWSO on 23 Jan 2016 and recaptured there on 13 Mar 2016, 21 Nov 2016, 26 Jan 2017, and 25 Mar 2017. During the earlier study period, 1661-23032 was banded at ARUN on 22 Apr 2007 and recaptured two winters later, on 19 Oct 2008, and 1671-31849 was banded at ARUN on 3 April 2010 and recaptured there on 17 and 24

October 2010. Including all data, 2.4% of the 296 Lincoln's Sparrows banded in this study were captured at least once in a different winter than the one in which they were banded.

*Discussion.*—Although little published information is available on wintering Lincoln's sparrows, the substantial variation in birds banded over the main study period was expected, given the range of precipitation observed semiarid, subtropical climate. The 2010–2020 censuses on East Foundation ranches across South Texas also showed high annual variation in Lincoln's Sparrows, but with a significant relationship to precipitation in only one of the three ranches studied (Slifka 2021). Thus, precipitation seems to be important when understanding Lincoln's sparrow winter site fidelity, but other factors, such as annual variation in migration patterns may need to be considered (Thurber 1980, Ortiz et al. 2012).

Weather to the north of Texas may be important in determining how many Lincoln's Sparrows are pushed south, as Lockwood (2001) suggested. The winter of 2018–2019 was the snowiest across the Great Plains in the past decade (Erdman 2018, NOAA 2019), with several storms in the fall. We banded the greatest number of Lincoln's sparrows at our sites that winter. In contrast, the winter of 2019–2020 was much warmer than normal across the U.S. (NOAA 2020) and we captured few Lincoln's sparrows at either site. Our between-winter return rate of about 2% was much lower than the 50–60% return rates in a California study of Lincoln's sparrows (Sandercock & Jaramillo 2002). We are unsure whether this discrepancy was due to more intensive banding efforts or to more predictable precipitation in the coastal California study site. It was also lower than the 25.9% return rate shown by Swamp Sparrows (*M. georgiana*) wintering in Mississippi (Herbert & Mowbray 2020). Our within-winter recapture rate of about 26% cannot be compared directly to other data on Lincoln's sparrow because few studies report within-winter site fidelity (Sandercock & Jaramillo 2002).

Overall, our data suggest that birds do not exhibit high between-winter site fidelity, which would make sense given the variation in

precipitation and in large-scale weather patterns. Further study of the interaction between regional and local weather is needed to better understand winter habitat use and site fidelity.

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