

Migration Ecology of Harris's Sparrow in Nebraska: 2024 Report



Stephen J. Brenner

Audubon Great Plains

Western Nebraska Field Office

Joel G. Jorgensen

Nongame Bird Program

Nebraska Game and Parks Commission

Overview

The Harris's Sparrow (*Zonotrichia querula*) is a large, medium-distance migratory sparrow of central North America. While relatively common in the Great Plains during migration and winter, this species has experienced dramatic declines since the 1970s, with estimates ranging from 1.5-2.5% reductions in the population annually (Meehan et al. 2022). These estimates are based on Christmas Bird Count data conducted in the wintering range, which is restricted almost entirely to the southern Great Plains from south Nebraska, Kansas, Oklahoma, and north Texas. Despite these apparent declines, there has been little research on Harris's Sparrows during migration. Likewise, only a few studies have been conducted on Harris's Sparrows in its breeding range, presumably because of the remoteness of breeding sites in the tundra/taiga transition zone in northern Canada. As no direct human-modification of breeding habitat has occurred, it is considered unlikely that habitat changes on the breeding grounds are contributing to population declines (Norment et al. 2020). However, recent climate shifts have created ecological and resource mismatches for species breeding alongside Harris's Sparrow in Arctic and sub-Arctic Canada (Senner et al. 2017), which may be negatively impacting the populations of this unique sparrow.

Migratory and wintering habitat for Harris's Sparrow is characterized by weedy fields in grasslands with limited to moderate shrubby edge. Notably, this mix of landcover has been increasingly converted into large-scale row-crop agriculture in the Great Plains, with remaining weedy fields, prairie and natural edges becoming smaller and more fragmented across the wintering range (Hiller et al. 2009). This species is also one of the few passerines that occurs almost entirely within the central Plains during migration and non-breeding periods. It is also recognized as a species of conservation concern within the region (Rohweder 2022). Thus, there is pressing need to understand the ecology of this bird in the state of Nebraska and central Great Plains given the dearth of research and its conservation status.

Here, we summarize preliminary results from a research program initiated in 2023. The primary goal of this research is to cultivate a useable and informative dataset on the body condition, demographics, movements and stopover ecology of Harris's Sparrow in Nebraska during both spring and fall migrations. Research into migratory bird stopover ecology is becoming increasingly more sophisticated as new technologies allow researchers to track birds at stopover sites and beyond with less effort and over larger areas. Understanding the migration ecology of this species is critical to identifying possible regional causes of population decline related to habitat or phenological shifts.

Methods

We are utilizing the Motus (motus.org) automated radio-telemetry network to track movements of individual Harris's Sparrows. Recently erected Motus towers throughout the Great Plains have increased the ability to detect the stopover duration of birds and their subsequent migratory routes. We are using Lotek Nanotags weighing ~0.73 grams and which have a battery life between 220-380 days. These tags are also compatible with manual radio-telemetry tracking, allowing us to track birds at locations away from established Motus towers. We also are building a database of banded birds that do not receive radio tags in order to increase our understanding of body condition, stopover duration, and demographics in our state. We measured fat score and overall size of all banded birds as well as age and sex, when possible. Fat is the primary fuel source for birds during migration and is often indicative of individual condition and migratory success (McWilliams et al. 2004).

Field work began in fall 2023 at two study sites in central and eastern Nebraska: Audubon's Rowe Sanctuary and at a privately-owned tallgrass prairie tract in the Rainwater Basin, known colloquially as the International Field Station (hereafter; IFS). In fall 2024, we continued to use the IFS as a study site but added Audubon's Spring Creek Prairie following the recent addition of a Motus tower in summer 2024. These sites were selected based on both historical presence of Harris's Sparrow as well as the differing landscape and management contexts between sites. Harris's Sparrows are found in near equal total numbers across both properties, and all sites contains suitable habitat for this species during migration.

Spring Creek Prairie is a large (~344 ha) conservation property that contains native and restored prairie, limited shrub and woodland, and is actively managed for tallgrass prairie habitat. The landscape surrounding Spring Creek is a mix of other prairie conservation properties, private rangeland, and state-owned conservation properties with limited industrial agriculture overall. The IFS is a small plot (~6.25 ha) of native and restored tallgrass prairie with limited shrub. The landscape surrounding the IFS is almost exclusively industrialized agriculture/cornfields, with non-adjacent conservation properties owned by the U.S. Fish and Wildlife Service and Ducks Unlimited and all nearby private dwellings consisting of very limited wooded habitat occurring mostly as planted cedar shelterbelts. One of the emerging questions in this study is assessing any differences in stopover ecology of Harris's Sparrow based on differing landscape contexts.

Stopover duration was measured for tagged birds by either on-site Motus towers (Spring Creek and Rowe) or using a handheld VHF receiver compatible with the frequency and coding of Nanotags (IFS and Spring Creek, Fig. 1). The location of the Motus tower relative to the tagging area on the Rowe property (>300 meters), and the ground-dwelling nature of our study species (Crewe et al. 2019) limited Nanotag detections to departure flights only.



Figure 1. Tracking Harris's Sparrows at the IFS in Clay County, Nebraska, using a handheld VHF receiver.

Results

We affixed a total of 8 Nanotags to Harris's Sparrows on 19 and 20 October, 2023. Seven of these individuals were hatch-year birds, with the only one after-hatch year bird tagged at the IFS. All birds had limited fat reserves (score=0 or 1) at time of capture, except for one individual that had a score of 4. All three birds that were tagged at Rowe were detected by the local Motus tower during their presumed departure flights south from the sanctuary. Two birds were detected at foreign (i.e. Motus towers not at release sites) towers during fall 2023 in central Kansas and northern Oklahoma. A surprising number of birds tagged during fall 2023 (n=4) were also detected on their spring 2024 migrations at various towers throughout the Plains, including Kansas, Nebraska, Iowa, North Dakota, and Manitoba (Fig 2). We tagged an additional two birds in late April (4/29/24) at the IFS, and one of these birds was also detected in Canada (5/13/24) once in left Nebraska (Fig 2, right panel).



Figure 2. Spring 2024 migration tracks for two birds tagged in fall 2023 (left) and spring 2024 (right).

Measurements of fall stopover duration were limited to one bird from the IFS in fall 2023, with the estimated and maximum possible stopover duration measuring 33-35 days. Fall stopover duration for three birds tagged at Rowe ranged from 20 - 35 days (avg = 27.6). All birds departed their banding/stopover sites on evenings with north, northwest, or northeast winds.

We affixed 9 total tags (n=5 at Spring Creek, n=4 at IFS) on Harris's Sparrows during 23 and 24 October, 2024. Five of these individuals were hatch-year birds, and four were after-hatch year. We were able to estimate stopover duration for all tagged birds in fall 2024, and all birds had limited fat reserves (score = 0 or 1) at time of capture. Stopover duration at Spring Creek ranged from 2 – 14 days (avg = 9.4). Stopover duration at the IFS ranged from 2 – 22 days (avg = 16.5). All birds left banding sites on evenings with north

or northwest winds. Four birds were detected at foreign towers in fall of 2024, with all detections occurring in eastern and southern Kansas (Fig. 3a & Fig. 3b).



Figure 3a. Fall 2024 migration tracks from two Harris's Sparrow tagged at Spring Creek Prairie. Local departure date for each bird was November 6 (left) and October 31 (right).



Figure 3b. Fall 2024 migration tracks from two Harris's Sparrows tagged at the IFS. Local departure date for each bird was November 13 (left) and October 24 (right).

Discussion

Autumn 2024 marked year 2 of our study on the stopover and movement ecology of Harris's Sparrow in Nebraska and the Great Plains. We were able to obtain a complete stopover dataset for all nine birds tagged during this season and increase the number of total Motus Network detections for our project. We were also able to refine our methods for local tracking and site selection. Overall, 21 Harris's Sparrows

have been outfitted with Motus tags since October 2023, with more deployments scheduled for spring 2025. We will also continue to build up our dataset of banded Harris's Sparrows without Motus tags across our study area (current total = 12).

One major takeaway from our limited dataset thus far is that most Harris's Sparrows that migrate through Nebraska in fall do not winter in the state. This is supported by the bulk of our outside Motus station detections in fall (Fig 3a and 3b) and the initial detections of birds in spring of 2024 (Fig 2). Likewise, visual surveys conducted in fall of 2024 at the IFS and Spring Creek noted steep declines of all Harris's Sparrow abundance at each site by the second half of November (J. Jorgensen pers. observation, J. St. Sauver pers. communication). Annual fluctuations in winter weather also likely play a factor in the number of sparrows that will winter in the state.

All Harris's Sparrows that were tracked and banded in fall 2024 were initially captured with limited fat reserves (fat score = 0 or 1). The same is true for birds captured and tracked in autumn of 2023, with the exception of one bird tagged at Rowe with a fat score of '4' at capture. This bird subsequently had the shortest stopover in 2023 of 19 days (2023 average = 29.25 days). This observation generally conforms to migration theory on stopover, as birds with higher fat reserves are more likely to depart on longer migratory flights (Deppe et al. 2015) or are able to depart earlier from a stopover site (Cooper-Mullin and McWilliams 2022). Birds captured but not tracked later in the 2024 season (Oct 31 and Nov 6) at the IFS all had higher fat scores (avg=2.3, n=6) than the birds captured earlier in the season (avg=0.2, n=10), suggesting that many birds tagged early in the season were recent arrivals to the study area at time of capture and most birds were likely refueling at the stopover sites as the season progressed (Brenner and Jorgensen 2021).



Figure 4. Hatch-year Harris's Sparrow with Nanotag.

Fall stopover duration was shorter at Spring Creek Prairie for most tagged birds versus birds at the IFS in autumn 2024 and 2023, as well as birds at Rowe Sanctuary in autumn 2023. Given our low sample size, we are not in the position to make any firm conclusions from these data at this point. It is unclear how differences between years impacts departure decisions for Harris's Sparrows in our region. However, relatively short stopovers compared to birds with similar body conditions at different sites might indicate higher stopover habitat quality, as birds are generally able to rest and refuel easier and faster at higher quality stopover sites (Brenner and Jorgensen 2021, Cooper-Mullin and McWilliams 2022).

Future Directions

Overall, we have established a solid foundation and proof-of-concept for using the Motus network to study the migration ecology of Harris's Sparrows in Nebraska and the Great Plains. The increased

number of tagged sparrows on the landscape has also increased the number of detections at towers outside of our study area, a trend we suspect will continue as more birds are tagged across the seasons. Upcoming work in spring of 2025 will focus on building up a complimentary dataset for spring stopover use at our study sites, with more planned tagging scheduled for fall 2025 as well.

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