

**AMERICAN WOODCOCK (*SCOLOPAX MINOR*) ECOLOGY IN
EASTERN NORTH AMERICA – 2025 Annual Report**



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The Eastern Woodcock Migration Research Cooperative is a collaborative group partnered to understand the migratory ecology of American Woodcock in eastern North America. This project would not have been possible without the support of numerous state and federal agencies across the U.S. and Canada, as well as several universities and non-profit organizations.

This document contains draft information that has not yet been subject to peer review. As such any results or information reported herein should be cited as unpublished data unless otherwise indicated, and we anticipate interpretation may change as additional years of data are collected.

Cover photo: Kylie Brunette holding a tagged woodcock in Nova Scotia. Photo credit to Rachel Darling.

In Memoriam: We lost three valued collaborators over the past year; Doug Howell (1956-2025), Al Bourgeois (1950-2025), and Kelsey Sullivan (1973-2026). All were talented biologists who were passionate about game birds and made significant contributions to the EWMRC.

Doug Howell was the Migratory Game Bird Coordinator for the North Carolina Wildlife Resources Commission. Doug coordinated our capture efforts in North Carolina, secured funding for GPS tags and data fees, and connected us with other wildlife managers in the state to support woodcock captures and nest searching. Through his role in the Atlantic Flyway Council, Doug also provided instrumental support during the early days of the cooperative by inviting our participation in the council's technical committee meeting when it was hosted in North Carolina, and connecting us to the Migratory Shore and Upland Game Bird Working Group. North Carolina's early engagement in the EWMRC via Doug's leadership helped us build capacity in the southeastern US, leading to work and collaborations in other states throughout the woodcock wintering grounds, which continues today.

Al Bourgeois had a distinguished career as a District Wildlife Biologist with the Virginia Department of Wildlife Resources. He became involved with the EWMRC when he captured some of Virginia's first GPS-marked woodcock in his region, and he continued to lead woodcock capture efforts well into his retirement, marking dozens of the Virginia woodcock in our dataset. Al was also a point person and invaluable resource in Virginia for Colby Slezak's efforts to locate woodcock nests from GPS-marked females during spring migration. Al was always excited to talk about woodcock and his bird dogs, highlighting his lifelong passion for the uplands and its wildlife.

Kelsey Sullivan spent 19 years as the game bird biologist for the Maine Department of Inland Fisheries and Wildlife, where he oversaw the state's monitoring and management of both migratory and non-migratory game birds. Kelsey's support was instrumental in helping the EWMRC to get off the ground during our first year, by securing state funds to pay for data transmission fees for the first transmitters we deployed in fall 2017. In 2020, he also led the logistics of woodcock captures at our Jackman, Maine study site. Kelsey was a friend and close colleague of the UMaine research group, and his calm demeanor, kind nature, and hard-working professionalism is greatly missed.

Executive Summary

The American Woodcock (*Scolopax minor*) is a migratory forest bird that has experienced population declines of an average 0.63% per year since 1968. Woodcock migration has traditionally been challenging to study, leading to limited information about migratory ecology to inform management. We initiated the Eastern Woodcock Migration Research Cooperative in 2017 to provide insights into woodcock migration in the Eastern Management Region, and we have since expanded our focus to the species' entire North American range. This report documents data collection and preliminary findings from the past year, presents major results to date, and describes our future directions. Publications and previous year's annual reports can be found at woodcockmigration.org/research. Highlights from this report include:

- **Field data collected to date:** From Fall 2017 – Summer 2025, we deployed 807 GPS transmitters on woodcock captured in 15 states and 3 Canadian provinces throughout eastern North America. As of summer 2025, we received data from 764 unique deployments, totaling 44,000+ datapoints. We also collected feather and/or blood samples from most marked woodcock, which we used to assess woodcock population structure via genomic and isotopic methods.

- **Student and alumni updates:** At the end of 2024, Rachel Darling advanced to Ph.D. candidacy, and in Fall 2025 created and taught “Birds in the Anthropocene”, a seminar and research skills development course for undergraduate students. Also in Fall 2025, Dr. Liam Berigan accepted the position of Assistant Professor of Quantitative Ecology at Auburn University in Alabama, and is joining in the EWMRC's upcoming work on woodcock wintering ecology. In Fall 2025, Kylie Brunette decided to join the ranks of EWMRC doctoral students by transferring to the UMaine Wildlife Ecology PhD program. After completing her M.S. from SUNY-Brockport, Kayleigh Filkins accepted a position as Environmental Educator at Wilton

Wildlife Preserve and Park in New York. Dr. Colby Slezak is currently working for the USDA as a Wildlife Scientist studying the movements of feral swine in Colorado, and Dr. Alex Fish is the Endangered and Threatened Species Coordinator with the Maine Department of Inland Fisheries and Wildlife.

- *Manuscripts accepted or published during 2025:* Three manuscripts were submitted for publication, with two accepted and one pending. This includes work by Liam Berigan on woodcock flight altitudes and collision risks, Alex Fish on woodcock migratory cues, and Kylie Brunette's paper describing unique woodcock nest defense behaviors. Additionally, Colby Slezak published two papers from his dissertation focused on woodcock nesting and survival in Rhode Island.

- *Genomic analysis of population structure:* As of summer 2025, our second round of genomic samples (n=125; blood or feather), mainly collected from Louisiana in 2024, the 2024 Canadian National Harvest Survey, and woodcock broods in Maine, were sequenced and are awaiting bioinformatic processing and analysis, to be performed in the next couple months.

- *Work in progress:* In the upcoming year we plan to conduct analyses examining the genomics and connectivity of woodcock across their range, evaluate wintering and breeding site fidelity based on our GPS data, conduct an isotopic analysis of woodcock breeding range limits, continue to evaluate the woodcock Singing Ground Survey and other woodcock management systems, and move forward with in-progress manuscripts examining woodcock use of different land ownership types and survival during different stages of migration.

- *The future of the EWMRC:* This cooperative began in 2017 with a specific goal – to increase our knowledge of American Woodcock Migration in the Eastern Management Region – but as the cooperative has grown, it has also evolved. Now, 8 years later, our scale encompasses the entirety of the woodcock's range, and the full scope of the annual cycle. In the coming years, we

anticipate the next horizon for the cooperative will focus on woodcock wintering, and cooperators from throughout the wintering grounds have begun work on an exciting new initiative focused on improving our capacity for conservation of wintering woodcock. With all of that said, we believe the time has come to transition the cooperative to version 2.0, and in the coming year we plan to implement changes that better reflect the current breadth of our research. This will likely include some updates to the project web page, and importantly, a re-naming of this cooperative research effort. While “EWMRC” has served us well for 8 years, something more general – the “American Woodcock Research Cooperative” is the current front-runner – will serve us better moving forward. However, our overall goal remains unchanged: to leverage the power of collaborative research to advance our understanding of American woodcock, and in doing so, support the conservation of this incredible bird.

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Introduction

The American Woodcock (*Scolopax minor*; woodcock hereinafter) is a migratory forest-dwelling scolopacid that has experienced long-term declines of 0.63% per year over the past 57 years (Seamans and Rau 2025). Woodcock are distributed throughout eastern North America; primarily breeding in the northern United States and southern Canada and overwintering in the southern United States. The species is managed as two discrete populations associated with the Central and the Eastern Management Regions (Figure 1). Woodcock generally migrate south between October – December and north between January – April (Krementz et al. 1994, Butler 2003, Meunier et al. 2008, Moore 2016). Prior studies of woodcock migration were principally derived from observations of local changes in woodcock abundance (e.g. arrival of spring migrants) and radio-tracking studies at breeding, wintering, and stopover sites. While this information is useful, it is inherently limited in scope and cannot be applied broadly across the species' range. This knowledge gap prompted the Association of Fish and Wildlife Agencies to identify migratory ecology as one of the woodcock's greatest research needs (Case & Associates 2010).

Tracking woodcock throughout migration presents numerous challenges, as individuals must be continually relocated over vast distances, almost always spanning numerous states and often two countries (Myatt and Krementz 2007, Klaassen et al. 2014). Recent technological advances allow for woodcock to be tracked using satellite transmitters (Moore 2016). Satellite transmitters can now simultaneously collect global positioning system (GPS) location data and remotely transmit locations to a central database via satellite networks. Between 2014 and 2016, Moore (2016) used satellite transmitters to track migrating woodcock in the Central Management Region but were unable to track more than a few woodcock that migrated into the eastern half of the range. To that end, we created the Eastern Woodcock Migration Research Cooperative in 2017, with the goal of describing the migratory ecology of woodcock in the

Eastern Management Region using satellite-enabled telemetry. As the cooperative has evolved over the past 8 years, we have included other research methods and expanded our focus beyond migration to the woodcock's full annual cycle.

In this report, we document data collected during the project's first eight years, summarize observations of GPS-marked woodcock during our most recent year, Fall 2024 – Summer 2025 (see **Appendices**), highlight several noteworthy findings from the past year, present scientific products from the collaborative to date, and provide a description of work in progress and outreach accomplishments. Previous years' reports, scientific publications, and links to publicly available products can be found by visiting woodcockmigration.org/research.

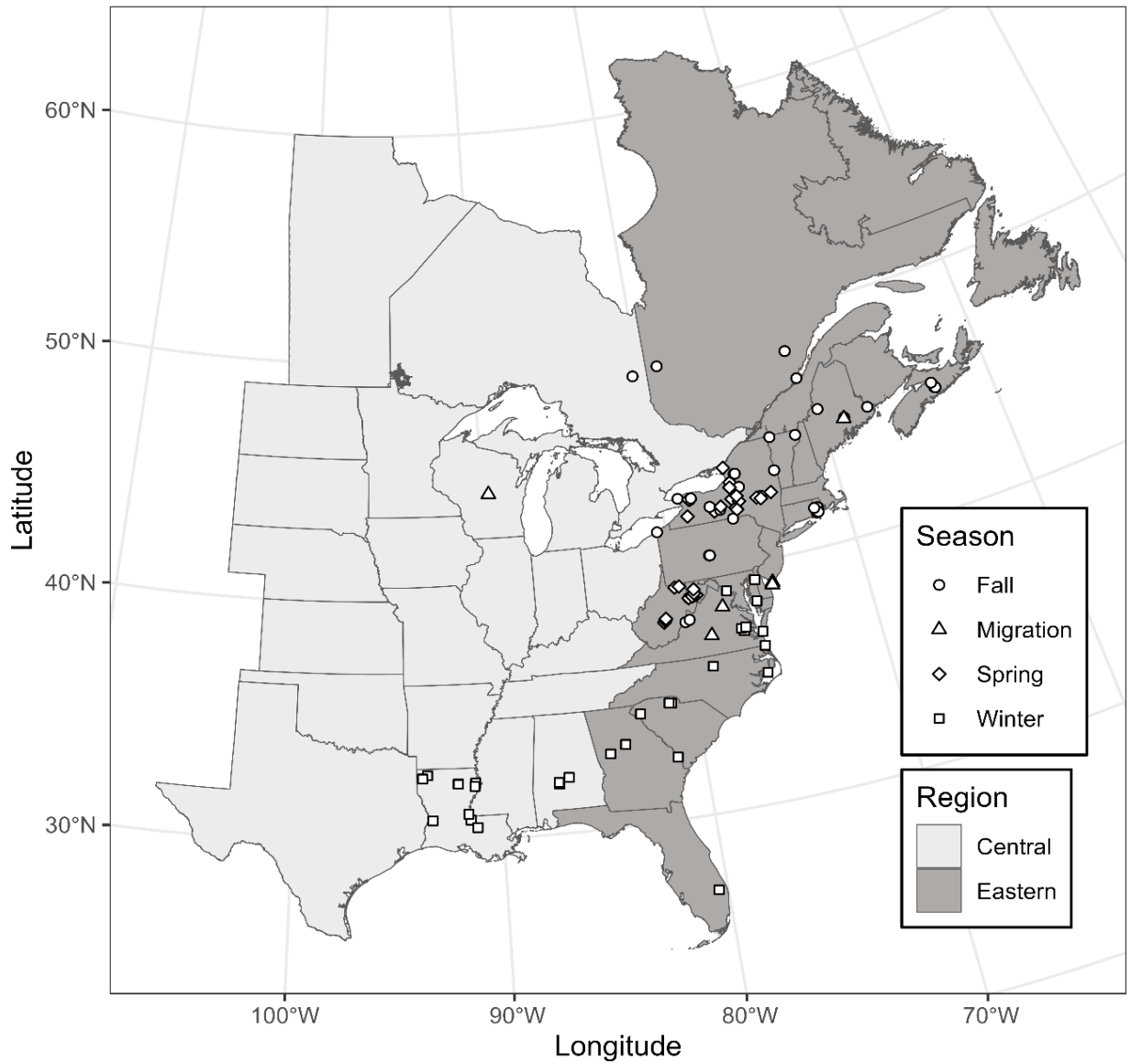


Figure 1. American Woodcock Central (light gray) and Eastern (dark gray) Management Regions, with white points indicating capture locations and shape of the point indicating the season during which captures occurred.

Methods

Study Area

The Eastern Woodcock Migration Research Cooperative study area encompasses the entire American Woodcock breeding range. Initially we focused on the Eastern Woodcock Management Region, the spatial unit at which the United States Fish and Wildlife Service and Environment and Climate Change Canada manage woodcock populations. However, as the cooperative evolved, we increasingly worked with collaborators in the Central Management Region. During the fall (September – October), we focused capture efforts in ME, NY, PA, RI, VA, VT, and WV in the U.S., as well as NS, ON, and QU in Canada. During winter (December – February), we focused capture efforts in AL, FL, GA, LA, MD, NC, NJ, SC, and VA. During the spring (April – June), we focused capture efforts in NY, WI, and WV (see Figure 1 for locations). We relied on the knowledge of local partners to identify areas suitable for woodcock capture within states and provinces, and we deployed transmitters on a wide variety of land ownership types, including state, federal, non-governmental organization, and private. As woodcock departed for spring and fall migration, they traversed multiple states and provinces throughout the eastern United States and Canada.

Capture

We captured woodcock using mist nets during crepuscular flights (Sheldon 1960) and by spot-lighting roosting birds (Rieffenberger and Kletzly 1966, McAuley et al. 1993). We set mist net arrays near roosting fields, travel corridors, and forested wetlands to capture birds as they left diurnal use areas and flew to night roosts. Additionally, we used spotlights and thermal imaging scopes to locate woodcock roosting in fallow, agricultural, or (new in 2024) pastoral fields, and captured them using handheld nets. Once captured, we aged woodcock to two age classes (adult [after hatch year or after second year; > 1 year old] or young [hatch year or

second year; < 1 year old]) using wing plumage characteristics and sexed (male or female) them using a combination of wing plumage and bill length (Mendall and Aldous 1943, Martin 1964). Woodcock were fitted with a Lotek PinPoint 75, 120, or 150 ARGOS-compatible satellite transmitter, attached with a leg-loop style harness (Moore 2016). The satellite transmitter collected GPS locations at pre-programmed dates and times, and transmitted data to a central database using the ARGOS satellite system. We stopped receiving locations when birds either dropped their transmitter or died, thereby causing the transmitter to rest on the ground and attenuate the signal, or if the transmitter's battery died or the transmitter otherwise failed. We are working towards methods to differentiate tag loss/failure from mortality to estimate survival from the GPS location data (see *Work in Progress*).

Transmitter Schedules

Transmitters were manually programmed using Lotek PinPoint Host software (Lotek Wireless Inc., Newmarket, Ontario, CA), which allowed us to specify the exact date and time locations were collected. Transmitters had limited battery life and were expected to collect a maximum of 75, 100, and 125 locations for the PinPoint 75, 120, and 150 tags, respectively, before losing power. We initially created three location collection schedules; frequent (one location per day), infrequent (one location every few days), and hybrid (combinations of frequent and infrequent periods) to maximize the amount of data we collected for each woodcock. Hybrid schedules contained a frequent collection period (~30 days) during the peak of migration, and infrequent collection periods before and after the frequent period. Frequent and infrequent schedules were used on both sexes during both fall and spring migration. Hybrid schedules were primarily used during spring migration, as the potential migration period exceeds the expected number of GPS locations possible under a frequent schedule, and also during the special case of fall migration from Nova Scotia across the Gulf of Maine (details below). Frequent schedules are useful to evaluate fine scale movement and provide the finest resolution

(i.e., one day) to document stopover (resting periods during migration) ecology. Infrequent schedules allow for woodcock to be tracked for longer periods of time, thus possibly providing data on both spring and fall migration for an individual bird. Infrequent schedules also increased the probability of receiving future data transmissions when individuals used stopover sites with poor satellite signal and failed to upload locations (e.g., mountainous areas with a steep slope).

From Fall 2017 – Spring 2020, we set transmitter schedules to take locations exclusively during the afternoon to capture woodcock stopover habitat use. Beginning in Fall 2020, PinPoint tags were manufactured to record the altitude of GPS locations, which introduced the capability to differentiate between night flight and night stopover locations. Accordingly, in Fall 2020 we began altering our transmitter schedules to take advantage of the ability to capture migratory flight points. We created schedules that took a combination of day and night locations, and schedules that took night locations only, which we randomly assigned to woodcock, attempting to control for age and sex ratios by program and capture location. In Fall 2023 & 2024, we created an overwater schedule (2-3 locations taken per night) to try to capture the routes woodcock use when they leave Nova Scotia. Location data were transmitted to a remote database using the ARGOS satellite system after every third GPS location was collected. We manually downloaded woodcock locations every 1 to 5 days and used Movebank (Kays *et al.* 2022) to store all location data.

To determine whether each woodcock movement included a full migratory departure, transit, and settling stage, we classified the beginning and end point of each track. The first point in a sustained, directional movement of greater than 16.1 km per step was classified as the beginning of a migratory movement, while the last point before that movement switched to undirected, < 16.1 km steps was classified as the end of the migratory movement. If a bird stopped transmitting before the end of its migration, we determined whether its final step was migratory or post-migratory based on a hidden Markov model framework (see Berigan *et al.* in

revision **below**). If the last location received from the bird was a part of a migratory step, then the migratory trajectory was classified as incomplete and excluded from statistics on the distance traveled during migration and time spent migrating. Additional analyses were performed for specific objectives, as described in each corresponding results section.

Data collected to date

Since the EWMRC began in Fall 2017, we have deployed 807 transmitters on birds captured in 18 states and provinces (Table A1). Of these transmitters, 764 gathered and transmitted at least one location, reflecting a deployment success of ~95%. We have collected more than 44,000 woodcock locations over the course of the project, or an average of 57.6 locations per marked bird (Figure 2, Figure 3). The number of woodcock captured and data collected have been evenly distributed among age and sex classes (Figure 2), and while location data is clustered the Eastern Management Region, we have collected woodcock locations from nearly all states and provinces within the species' range (Figure 3). Since altitude capacity was introduced on PinPoint transmitters in Fall 2020, we have also recorded at least 175 nocturnal flight locations that can be used to characterize woodcock flight altitudes during migration. During Fall 2024 and Spring 2025 migrations, we recorded over 64,000 kilometers of migratory movements from 104 woodcock.

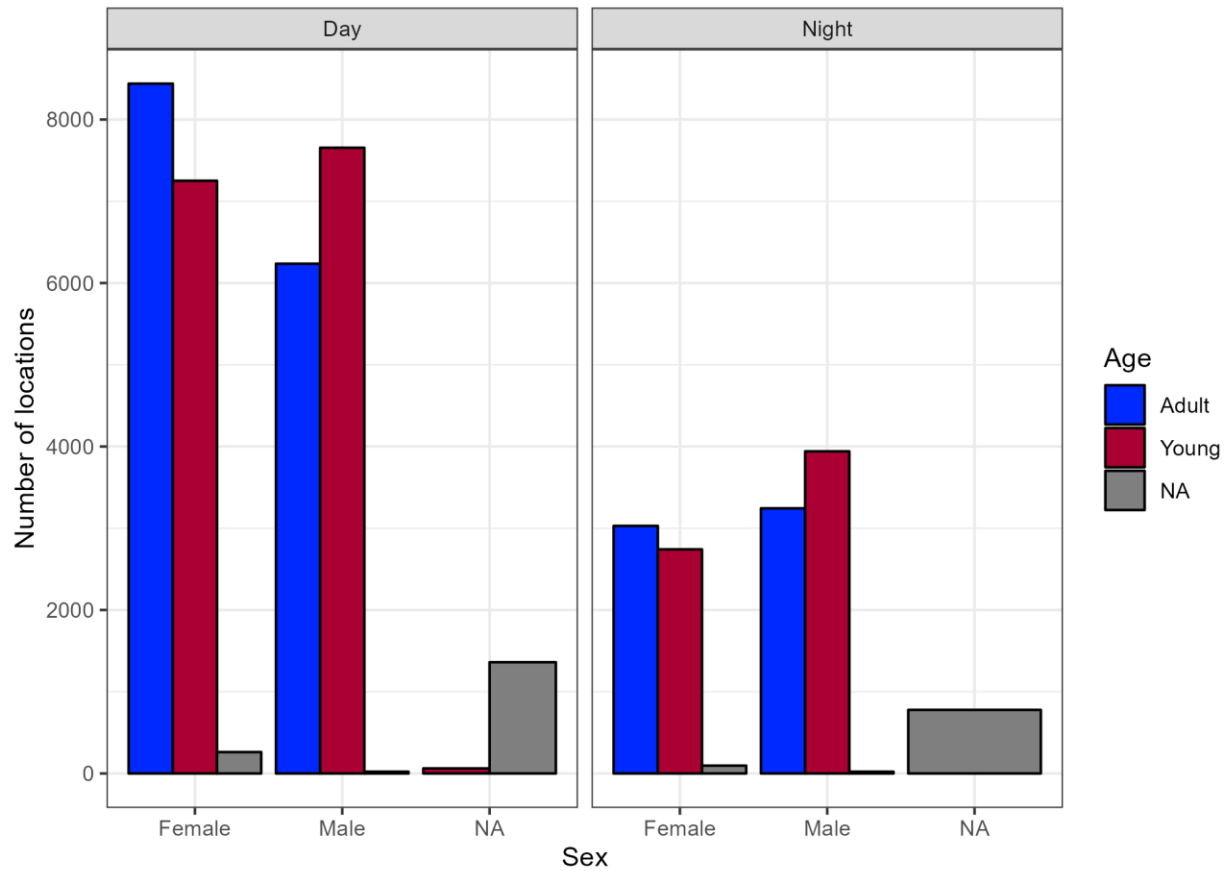


Figure 2. Counts of GPS locations recorded by tagged woodcock from Fall 2017 – Summer 2025. Over 44,000 locations have been gathered since the project began, including day and night locations and large sample sizes from each combination of sex and age classes. 'NA' reflects birds not assigned a sex or age class at capture.

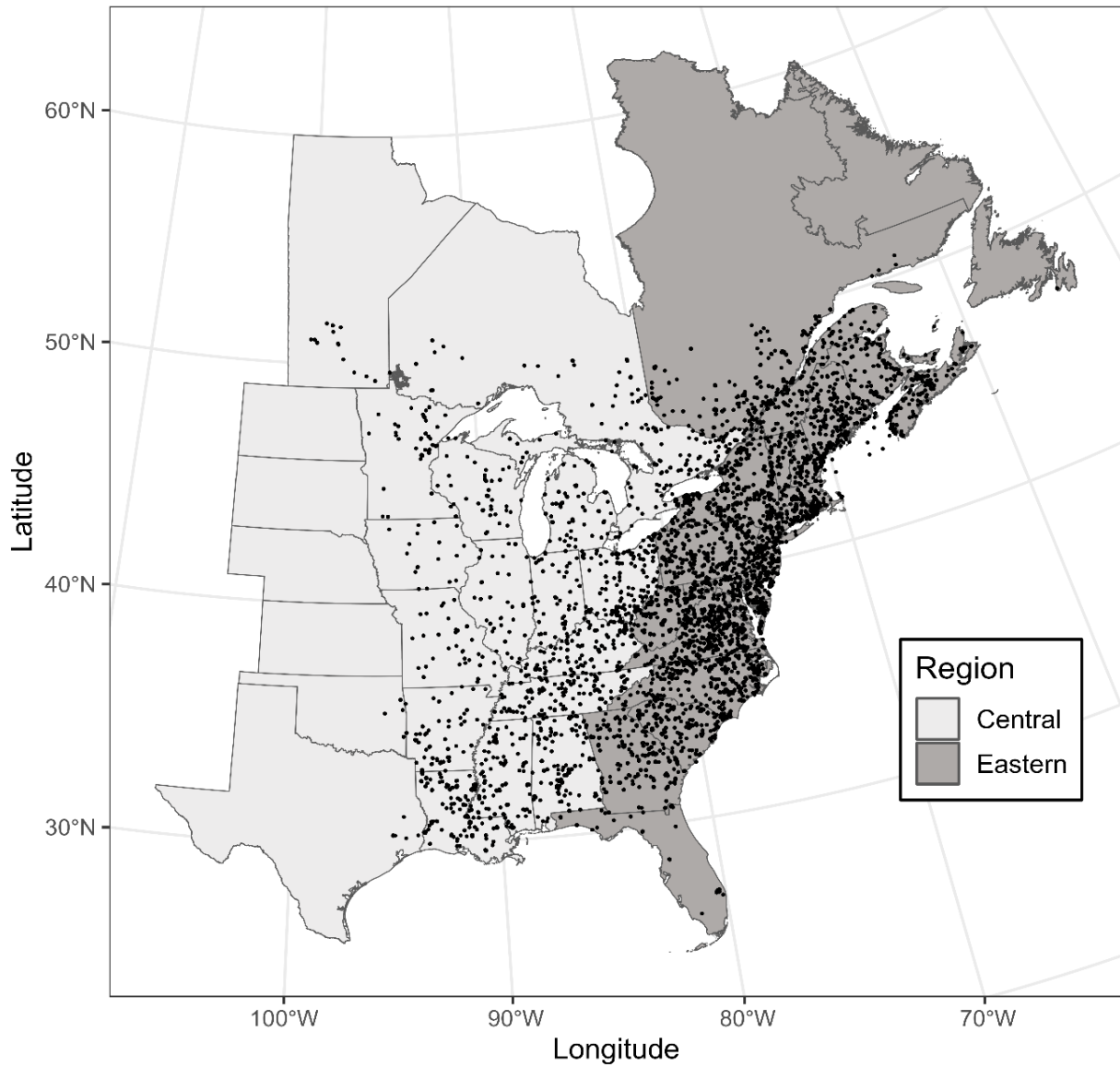


Figure 3. GPS locations (black points) collected by woodcock marked through the EWMRC from Fall 2017 – Summer 2025. Over 44,000 locations have been gathered since the project began. Location density is highest in the Eastern Management Region, but locations can be found throughout the entirety of the woodcock's range.

Recent Publications and Publications in Prep

1. Low migratory flight altitudes may explain increased collision risk for American Woodcock (Lead: Liam Berigan; *published in Ornithological Applications*).
<https://doi.org/10.1093/ornithapp/duaf017>

Abstract: Understanding bird migration at low altitudes is critical to evaluating risk of collision with obstacles; however, quantifying flight at low altitudes is often complicated by difficulty measuring low altitude flight using weather radar. Recent advances in satellite tracking technologies for avian species allow quantifying use of low altitudes by nocturnal migrants with a high level of precision, allowing species-level inference into potential collision risk based on use of risky altitudes. The American Woodcock (*Scolopax minor*) has long been considered a low altitude migrant due to its frequent collisions with buildings, and subsequent mortality during migration may be contributing to population declines. We investigated migratory flight altitudes using satellite transmitters deployed on woodcock in 2020–2024 and examined how flight altitudes compare to the heights of common airspace obstacles. Each transmitter recorded a nocturnal GPS location with an altitude reading every 1–3 days during fall and spring migrations. We implemented a Bayesian hierarchical mixture model to identify whether locations were recorded on the ground or during flight, isolate measurement error, and describe the distribution of flight altitudes. We found that migrating woodcock fly at mean altitudes of 379m (SD: 393m), flying higher during spring (mean: 444m, 95% credible interval: 333–578m) than fall (338m, 95% CRI: 267–423m). Woodcock flight altitudes were frequently lower than could be observed using weather radar (27% of observations), and 57% of observations fell within the altitude range of ≥ 1 airspace obstacle (Figure 4). Our results suggest that woodcock fly at altitudes lower than reported for most nocturnal migrants, which likely contributes to their vulnerability to obstacle collisions. Woodcock provide an example of how vulnerability to obstacle collisions during

nocturnal migratory flights are often species-specific, and mitigation efforts should incorporate measures aimed at reducing collisions during both diurnal stopovers and nocturnal migratory flights to effectively reduce bird collision mortality.

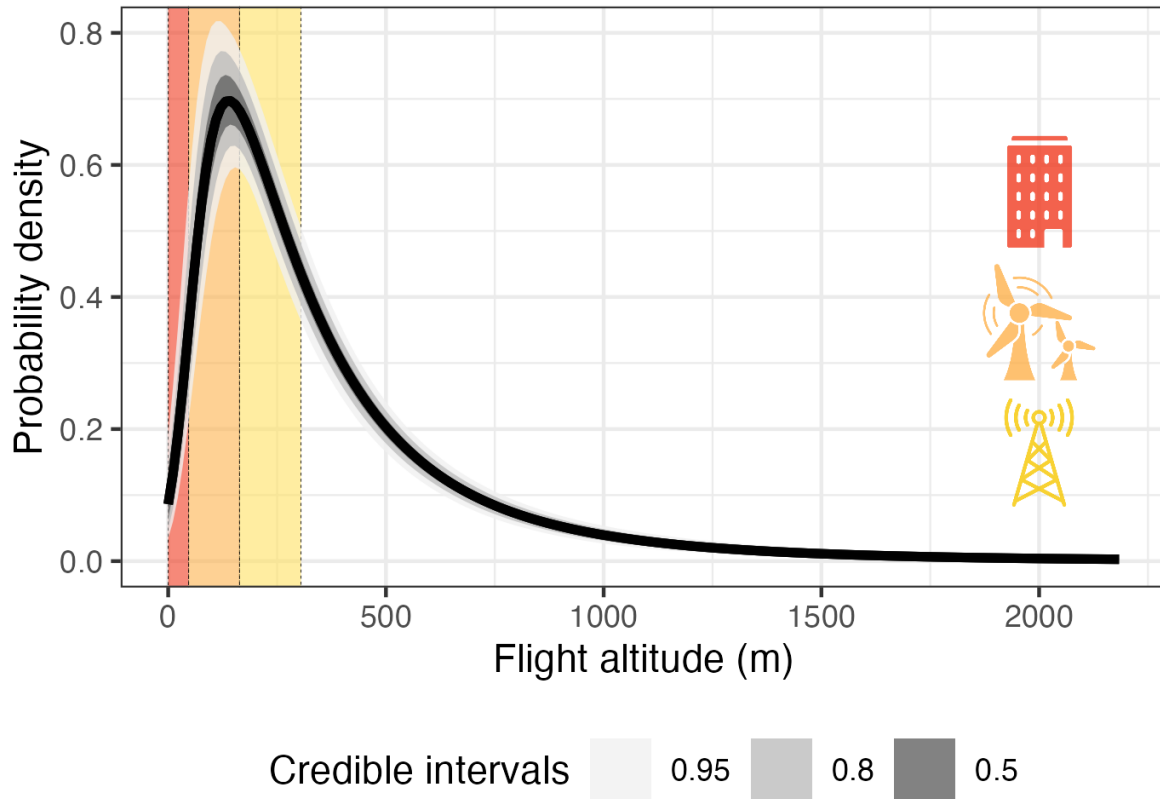


Figure 4. Distribution of American Woodcock (*Scolopax minor*) flight altitudes above ground level compared to the heights of low-rise buildings (red; 47 m), land-based wind turbines (orange; 32–164 m), and large communications towers (yellow; 244 m). The dark line represents the median flight altitude distribution calculated using the base model, while ribbons represent 50%, 80%, and 95% highest density credible intervals for the distribution. Raw altitude data were collected using GPS transmitters in the eastern portion of the woodcock’s range from 2020 to 2024.

2. Nine years of tracking data reveal high postbreeding survival of radiomarked male woodcock in Rhode Island. (Lead: Colby Slezak; *published in The Wildlife Society Bulletin*). <https://doi.org/10.1002/wsb.1591>

Abstract: To stabilize or increase populations of declining wildlife, it is essential to identify drivers of variation in survival. We evaluated male American woodcock (*Scolopax minor*) post-breeding survival and assessed the extent to which age, ordinal date, precipitation, and landscape habitat quality (indexed by relative probability of use scores) influenced post-breeding survival. Overall post-breeding survival estimates for 196 radiomarked male woodcock from May to September were high (i.e., 0.894, 95% credible intervals = 0.760–0.982), and the 4 covariates we assessed did not influence daily survival rate. The high postbreeding survival of woodcock during our study was consistent with the other estimates for the post-breeding period and is similar to other adult survival estimates throughout much of the annual cycle.

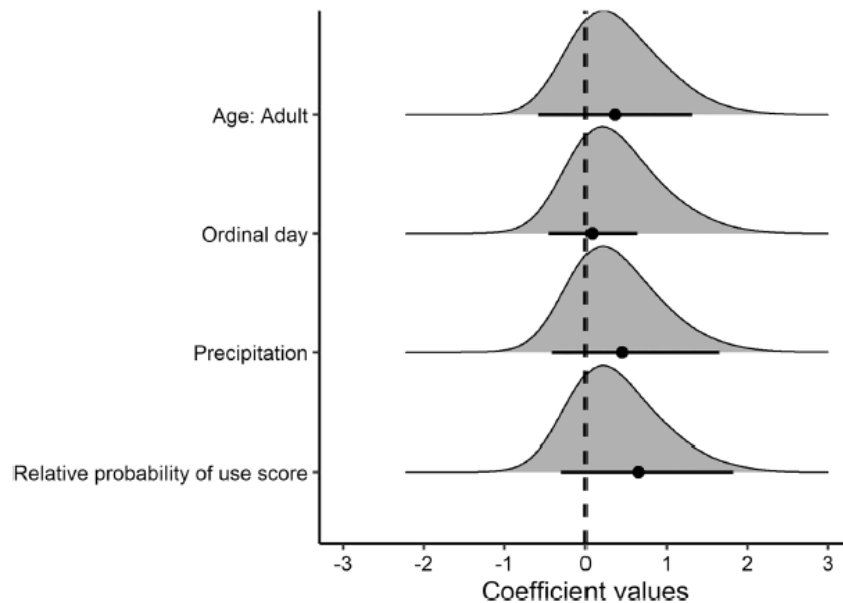


Figure 5. Posterior predictions from a post - breeding (15 May-1 September) daily survival model for male American woodcock captured in Rhode Island, USA, 2010-2021. The posterior

predictions illustrate the distribution of possible coefficient values for the fixed effects of 4 covariates. The points represent the mean values, while the horizontal black lines indicate the corresponding 95% credible intervals. The vertical black dashed line is at zero and used to visualize the direction of effects.

3. Mismatch between strong nest-site selection and low survival of nests and broods for *Scolopax minor* (American Woodcock) and its implications for conservation (Lead: Colby Slezak; *published in Ornithological Applications*) <https://doi.org/10.1093/ornithapp/duaf009>

Abstract: Nest-site selection may reduce predation and enhance recruitment, especially in ground-nesting birds. Few studies have examined both nest-site selection and its potential effects on nesting success, even though predation risk and exposure to inclement weather may limit the effectiveness of nest-site selection. We assessed home-range and local-scale nest-site selection of *Scolopax minor* (American Woodcock) as well as nest and brood survival in Rhode Island, USA during the breeding seasons (March 15 to June 15) of 2020–2022. Specifically, we employed a use/available design and conditional logistic regression models to evaluate nest-site selection and used the Program MARK to estimate nest and brood survival. At the home-range scale, we found that nesting woodcock selected for early successional cover types (i.e., pastures, grasslands, or regenerating clearcuts) and areas closer to upland young forest and reverting agricultural openings. They also occupied forests and wetlands of varied species composition and age (i.e., upland young forests as well as upland and wetland deciduous forests, and emergent wetlands). At the local scale, females selected nest sites that provided visual concealment of the nest. Despite nest-site selection at 2 spatial scales, nest and brood survival were low (10% and 16%, respectively) and were not influenced by vegetation, landscape configuration, and weather. Given that woodcock nest-site selection is driven by

vegetative structure and concealment, yet reproductive success was low, future management should experimentally alter forests to identify forest configurations that help mitigate predation and increase cover in fragmented landscapes, such as Rhode Island.

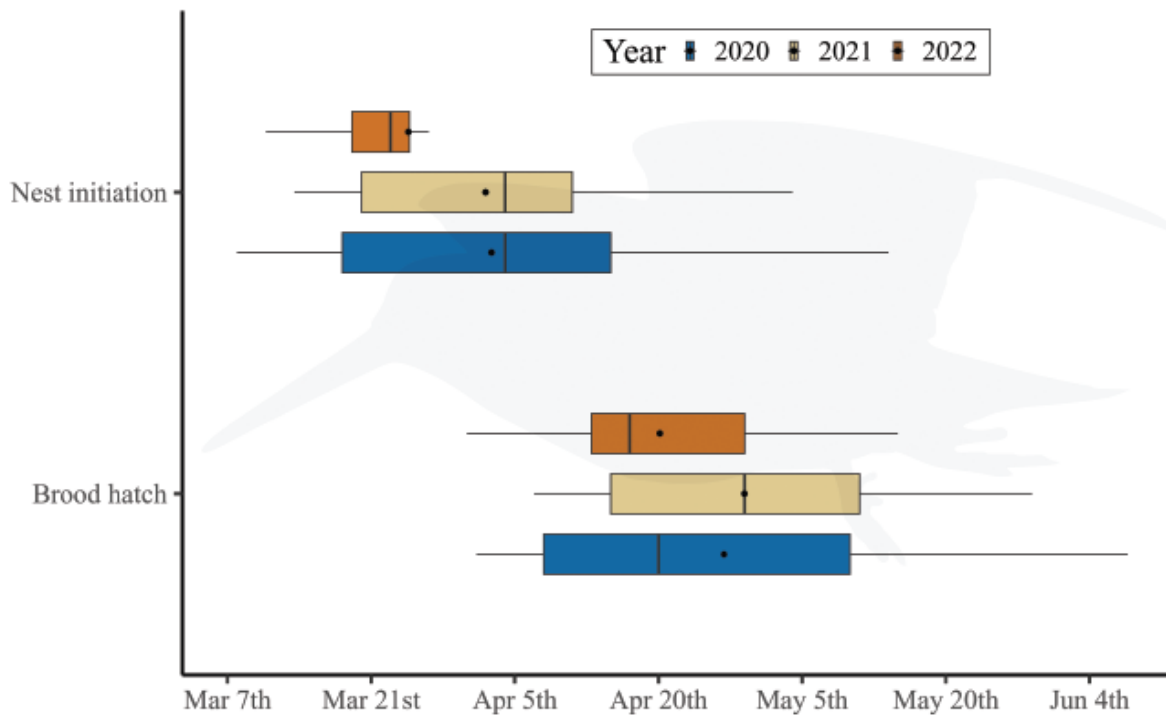


Figure 6. Nest initiation ($n_{\text{nests}} = 41$; $n_{\text{broods}} = 45$) and brood ($n = 62$) hatch date phenology by year for *S. minor* nests and broods located in Rhode Island, USA from 2020 to 2022. Boxes indicate median, mean (black point within box plot), 25%, and 75% quartiles. Whiskers represent the highest and lowest values within 1.5 times the interquartile range over the 75th percentile. In Rhode Island, nests are initiated in mid-March and continue through late-April, whereas broods typically begin hatching in mid-April and continue through mid-May.

4. Seasonal, age-, and sex-related differences in the use of external migratory cues by American Woodcock (*Scolopax minor*) (Lead: Alex Fish; *published in Ibis*)
<https://doi.org/10.1111/ibi.70042>

Abstract: Timing of migration is seasonal and tied to changing photoperiod; however, individual birds rely extensively on external environmental cues, such as weather, to assess likely flight conditions and make fine-scale decisions about migratory departures. Considerable variation may exist among individuals in how they respond to specific cues, in turn producing intraspecific variability in aspects of migration timing and flight distances. We were interested in how external environmental cues (e.g., weather, lunar cycles) were associated with departure decisions in American Woodcock (*Scolopax minor*), and whether there was consistent variation in these decisions among individuals based on their age and sex. Between 2017-2020, we captured and attached satellite transmitters to 304 American Woodcock throughout eastern North America and obtained location data as they migrated during both autumn and spring. We used conditional logistic regression and general linear models in a case-control study design, which allowed us to evaluate individual American Woodcock selection for potential cues at departure. We further explored how individual use of specific wind conditions influenced the distance covered during migratory flights. American Woodcock responded to barometric pressure, moon illumination, temperature, presence of tailwinds, and wind speed when making departure decisions, but selection varied by season, age, and sex (Figure 7). In autumn woodcock responded to tailwind assistance, and departed under lower temperatures and barometric pressure; however, young birds making their first migration were more responsive to temperature and less responsive to wind assistance than adult birds. During spring migration, female American Woodcock showed a greater selection for wind assistance and higher barometric pressure, whereas males showed stronger response to warmer temperatures and greater moon illumination. American Woodcock that departed using tailwinds generally had

longer flight distances, which we assume reflected more efficient flight associated with wind assistance. Adults were able to better capitalize on more favorable flight conditions during autumn migration, whereas decision-making during spring migration was instead driven by sex-specific motivations that were likely associated with breeding.

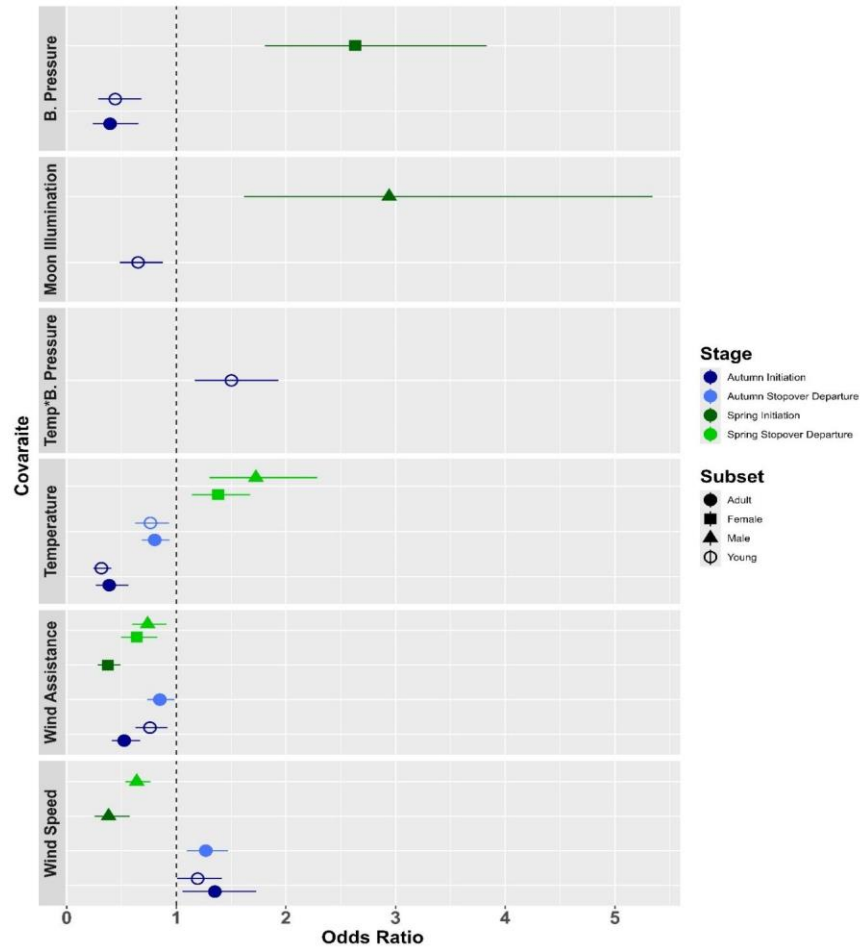


Figure 7. Odds ratios relating the effects of environmental cues on woodcock migratory departures from GPS-marked individuals tracked from 2017-2020. A value >1.0 (dashed line) indicates a positive association between the variable and odds of departure, whereas a value <1.0 indicates a negative association between the variable and odds of departure. Only odds ratios with 95% confidence intervals (error bars) that did not overlap 1.0 from competitive model

sets were included in the plot. All covariates were z-standardized, so the magnitudes of the effects within and between covariates are directly comparable.

5. Oh deer! Videography reveals a range of defensive behaviors against a cervid by a ground-nesting bird (Lead: Kylie Brunette; *in press, Ecology*)

Summary: Growing evidence confirms that cervids act as nest predators to many species of ground- and low-nesting birds. Despite this, there is little evidence of birds using active defense strategies to defend their nests from cervids; possibly due to small birds' unwillingness to defend against large animals, or because such interactions are difficult to observe within limited view frames of small nest cameras. In West Virginia in 2024 and 2025, we documented several instances of nesting woodcock hens reacting to and interacting with nearby white-tailed deer (Figure 8). The hens exhibited a range of active defensive behaviors, including vocalization, posturing, and aggressive chasing with physical contact. We speculate that variability in defensive behavior could be both situational and dependent upon the life history strategies of a species.

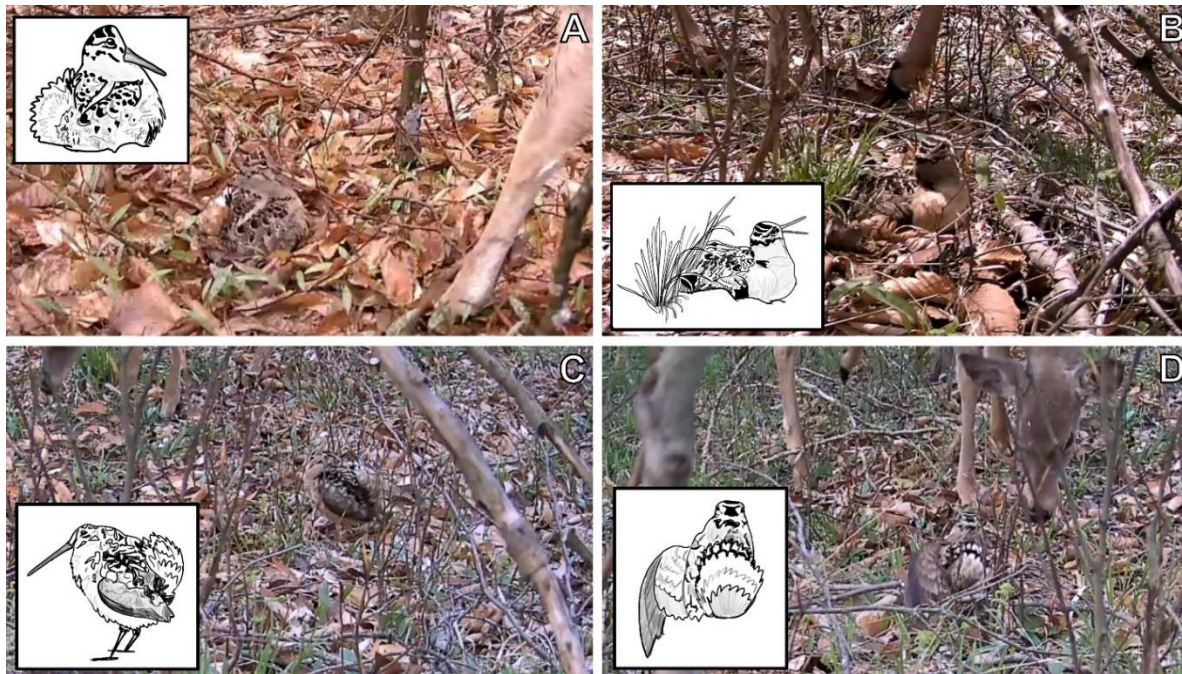


Figure 8. Examples of the range of active defensive behaviors exhibited by nesting woodcock hens captured by remote cameras in West Virginia. A) a hen postures defensively and vocalizes quietly while remaining on the nest, B) a hen lunges at a nearby deer with her mouth open while remaining on the nest, C) a hen in full defensive posture off the nest, and D) a hen prepares to fly directly into the face of a nearby deer. Frame A) is from one nesting hen, while frames B), C), and D) are from two separate events with another individual.

6. Joint life-stage-specific distribution models better facilitate habitat conservation for a short distance migratory bird (Lead: Liam Berigan; *in revision – target journal Biological Conservation*)

Abstract: Species distribution models have issues with cross-seasonal transferability when data collected during a single season do not reflect habitat relationships across other seasons. This issue can be addressed using spatial decision support systems, which allow users to incorporate multiple season-specific distribution models into a single tool to facilitate

conservation decisions. We demonstrated a potential application of this framework through an analysis of multi-season habitat use for American woodcock in Pennsylvania, USA. We modeled woodcock breeding and migratory habitat distributions in Pennsylvania, USA, using random forest classifiers, and integrated the predictions of both models into a single decision support system using a Shiny application, the Woodcock Priority Area Siting Tool, or [W-PAST](#) (Figure 9). The Shiny application accepts user input through breeding and migratory season weights, allowing users to customize the tool based on area-specific management priorities. We found that woodcock have low cross-seasonal transferability between breeding and migratory season models, with Pearson correlations of 0.15 at a pixel-scale and 0.39 at a local management area scale, indicating that conservation of breeding habitat alone is unlikely to result in efficient conservation of migratory habitat for woodcock. Woodcock breeding and migratory habitat is also unevenly distributed at a regional scale, with 3 Pennsylvania ecoregions having low breeding suitability but high migratory suitability. Creating a multi-season distribution model for woodcock management highlighted important migratory areas that may otherwise be overlooked due to a lack of breeding season occupancy, such as urban greenspaces. Flexibility in data sources and ability to compensate for low cross-seasonal transferability in distribution models make multi-season distribution modeling ideal for the study of birds and other migratory taxa.

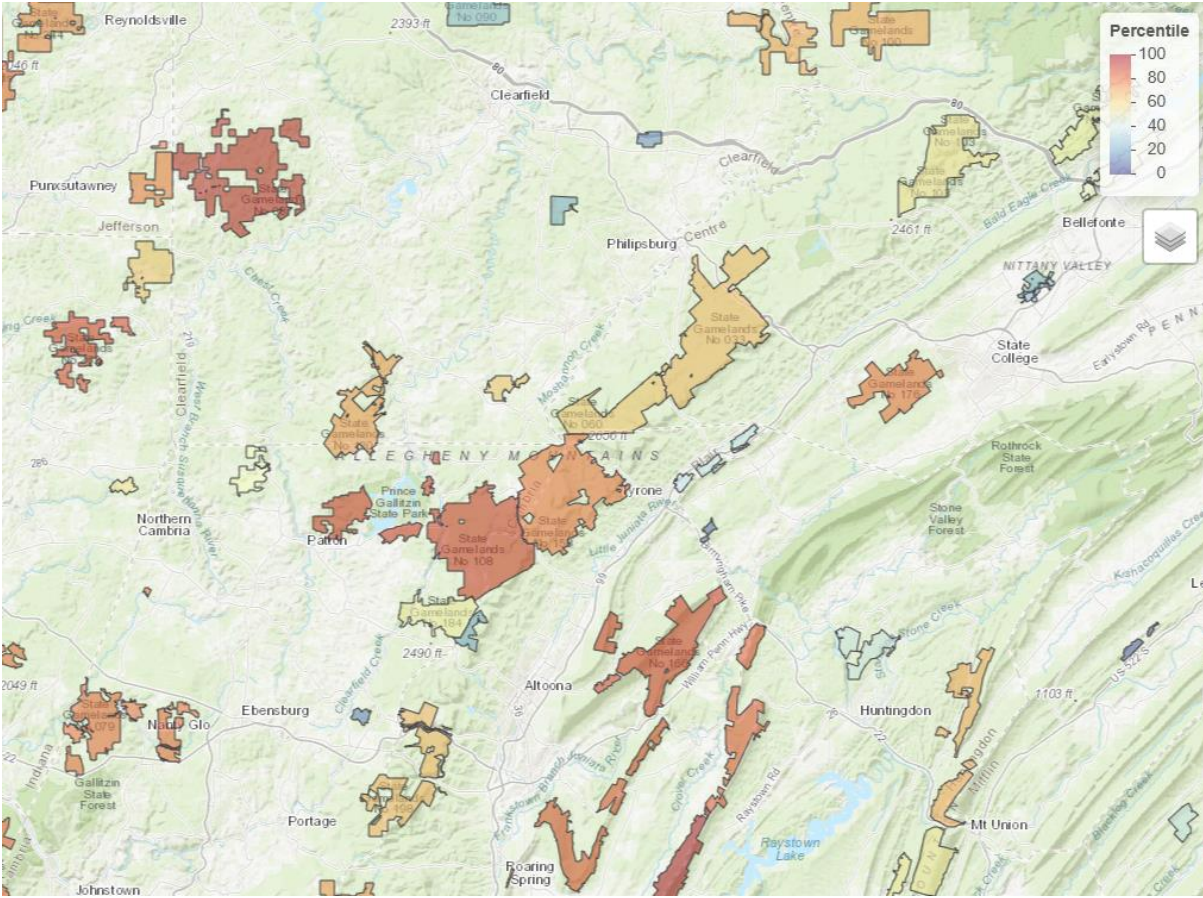


Figure 9. Screenshot of W-PAST depicting gamelands within and around the Allegheny Mountains, PA. Color represents the average landscape suitability index, with the 100th percentile (red) being the most suitable; migratory and breeding habitat are weighted evenly.

7. *Scolopax minor* (American Woodcock) cross the Gulf of Maine at low altitudes using three corridors during autumn migration, largely avoiding future wind turbine sites (Lead: Rachel Darling; *in prep*)

Abstract: A new and understudied hazard for migratory landbirds that cross large water bodies is offshore wind infrastructure, specifically wind turbines. To study the potential impacts of upcoming offshore wind development in the Gulf of Maine on migratory landbirds, we captured and deployed GPS satellite transmitters on *Scolopax minor* (American Woodcock) in Nova Scotia, Canada. We categorized birds' crossing strategies based on GPS locations recorded on Gulf of Maine coastlines and locations collected during overwater flights (n = 17). We used binomial generalized linear models to discern if weather conditions acted as overwater flight initiation cues for a subset of our tagged birds (n = 14). *S. minor* used three crossing strategies (Figure 10): northwest over the Bay of Fundy into New Brunswick, Canada (n = 5), west to west-northwest making landfall in Maine, USA (n = 10), and southwest making landfall in southern New England, USA (n = 2). The altitude of overwater flight locations (n = 9) averaged 311 m above sea level (ASL; range 10 - 1459 m), with four altitudes (18 m to 207 m ASL) occurring within or below the rotor-swept zone of currently manufactured offshore floating turbines. *S. minor* initiated overwater flights with higher barometric pressure and with winds generally blowing in a southerly direction, indicating selection for calm conditions and winds providing less resistance than the autumn prevailing winds (easterly to southeasterly). The majority of *S. minor* in our sample (>88%) will avoid the risk of collision with future offshore turbines in the Gulf of Maine, perhaps indicating landbird species will generally circumvent this risk. However, given rapidly evolving turbine technology, changes to leasing areas, and the volatility climate change introduces to weather patterns, additional studies of *S. minor* and other migratory landbird crossings of the Gulf of Maine are warranted, crucially before offshore development begins.

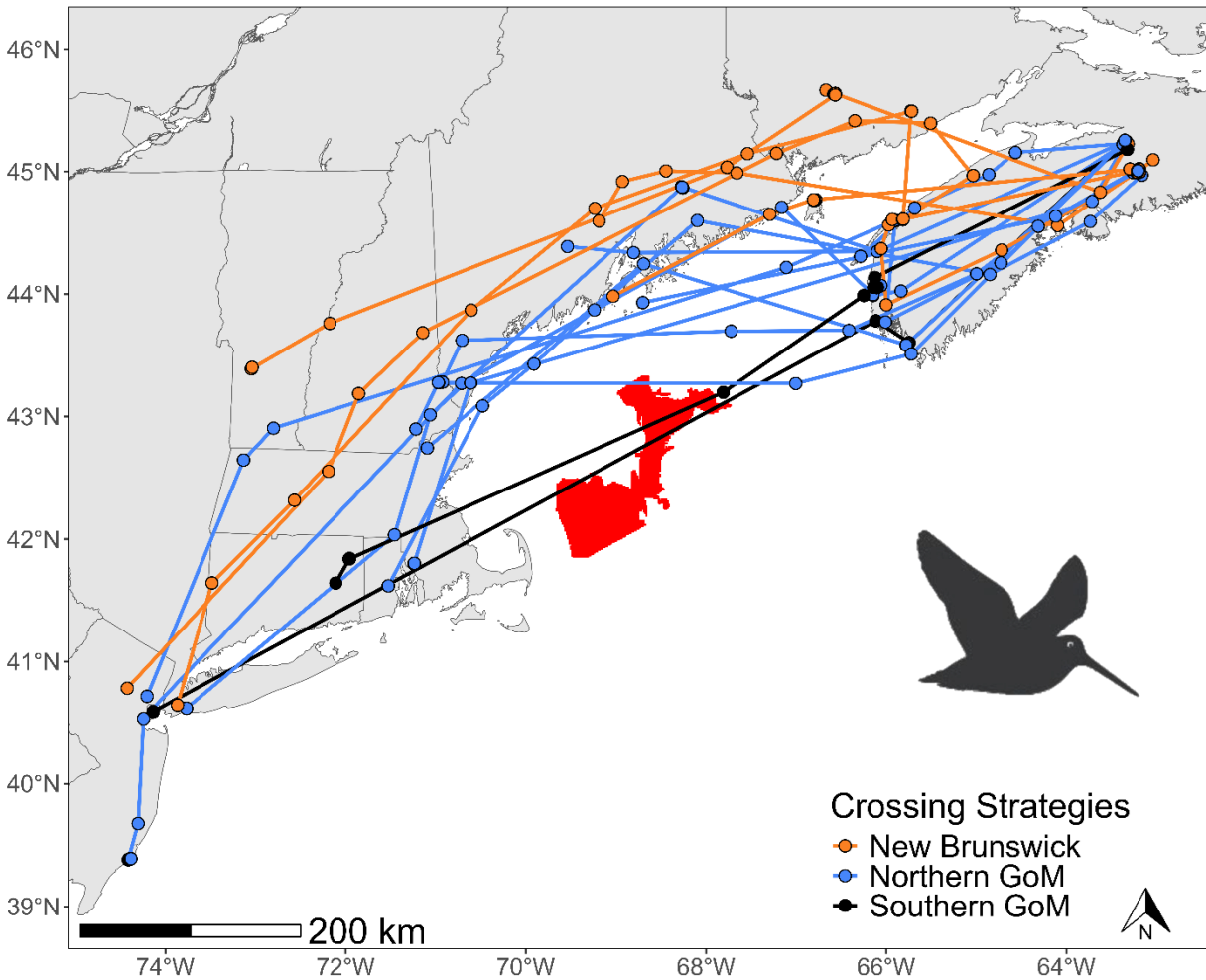


Figure 10. Approximate paths of 17 *S. minor* overwater crossings from Nova Scotia during their autumn migration; lines connecting points represent the shortest distance between points rather than tracked flight paths. Birds are colored by the crossing strategy they used, with most birds crossing either the Bay of Fundy into New Brunswick (orange tracks) or the northern GoM and making landfall along the Maine coast (blue tracks). Two birds, represented by black tracks, likely crossed the southern GoM to southern New England, through the formerly planned Wind Energy Area (red polygon).

8. Adapting hidden Markov models for tracking migratory birds using data from small GPS transmitters (Lead: Liam Berigan; *in revision*)

Abstract: Recent technological advances resulting in the widespread collection of tracking data from migratory birds necessitates tools for the effective processing and classification of that data. Tools such as hidden Markov models provide opportunities to classify movement states from high-resolution Global Positioning System (GPS) data collected at frequent, regular intervals. However, small-bodied migratory birds frequently cannot carry large enough tags to collect GPS data frequently. Use of additional data streams may assist with assigning cryptic movement states to sparse and irregular GPS data. Here we apply a correlated random walk model and additional data streams to fit hidden Markov models to GPS data from American Woodcock (*Scolopax minor*; hereinafter woodcock). Our objectives were to determine if the use of additional data streams resulted in an improved capacity to predict migratory states and characterize woodcock migratory distance, duration, phenology, and the presence of long-distance movements outside of fall and spring migration. We found that individual data streams only marginally improved model performance, but collectively data streams decreased model error rates by a median value of 5.93%. Migratory characteristics measured using the full model (all additional data streams) were similar to the base model (only step length and turn angle) for all birds during fall and for males during spring, although the full model was 2.12 times more likely to identify a migratory endpoint than the base model for females during spring. The mean duration and distance of migration was also underestimated by 7 days and 278 kilometers for the base model as opposed to the full model for females during spring. Long-distance movements outside of fall and spring migration, such as dispersals and foray loops (Figure 11), were less frequently identified with the base model (3 dispersals, 15 foray loops) as opposed to the full model (4 dispersals, 18 foray loops). Using additional data streams may be beneficial for birds with overlapping seasonal distributions and prolonged stopovers, demonstrating the

benefits that new or repurposed movement models may have for understanding avian migratory ecology.

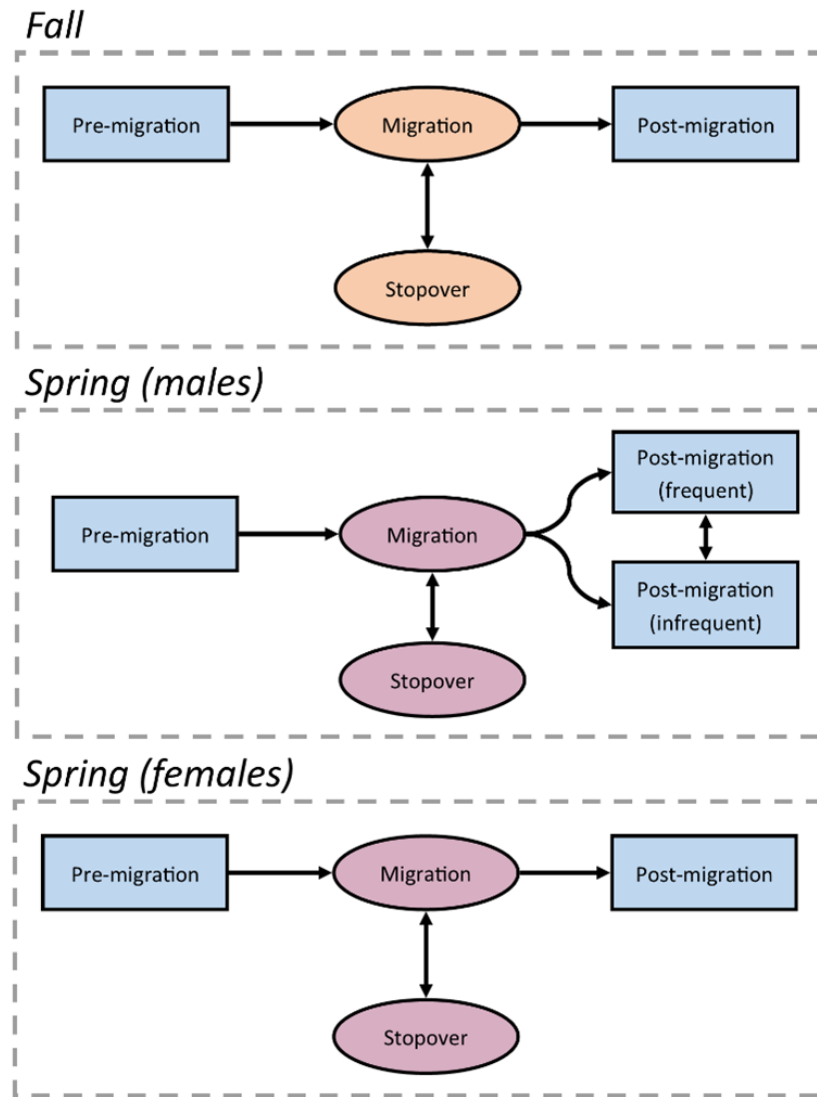


Figure 11. Movement state transition diagram for each hidden Markov model (HMM) classifying woodcock migratory states. Blue boxes represent pre- and post-migratory states, which include dispersals and foray loops, while orange and red circles represent states during fall and spring migrations, respectively. Arrows indicate directional transitions between states that we permitted within the HMM framework. The spring male model includes two post-migration states to compensate for less frequent GPS locations collected from males in late spring.

Works in Progress

1. American woodcock use of different land ownership and management types varies throughout the annual cycle (Lead: Sarah Clements)

In the US portion of the Eastern Management Region (EMR) for American woodcock, only 18% of land is managed by governments or non-governmental organizations (NGOs), however the relative amount varies considerably among states throughout the region. Accordingly, privately-owned lands likely contribute to the bulk of used woodcock habitat, but it is unclear how frequently woodcock use public versus private land ownership types throughout the region and during different stages of the species' annual cycle.

The objectives of this work are to (1) quantify the relative use of public and private land ownership categories by GPS-marked woodcock in the EMR during fall and spring migration, and during wintering and summering non-migratory periods, and (2) examine variation in woodcock use of different land ownerships and management status areas among states and bird conservation regions (BCRs) throughout the eastern United States. We classified land into government protected, private protected, private unprotected, and government unprotected management classes, based on an on national land ownership GIS layer. We used woodcock migratory data from 2017-2023, calculated the percent use of each land ownership category for each individual woodcock, and then averaged the percentages of locations within each management class across individuals.

Most woodcock use during migration occurred on private lands, however there was considerable variation among states as well as some regional patterns. In most of the NE and SE U.S., the majority of woodcock use during migration, >80%, occurred on private lands (Figure 12). However, in the mid-Atlantic, there tended to be greater woodcock use of

government lands, where in three states (MD, DE, NJ), 32-50% of migratory woodcock used government lands, and this use was at least 10% more than predicted based on availability. These patterns were largely mirrored during other periods of the annual cycle. We are continuing to develop this research, and plan to submit a publication during 2026.

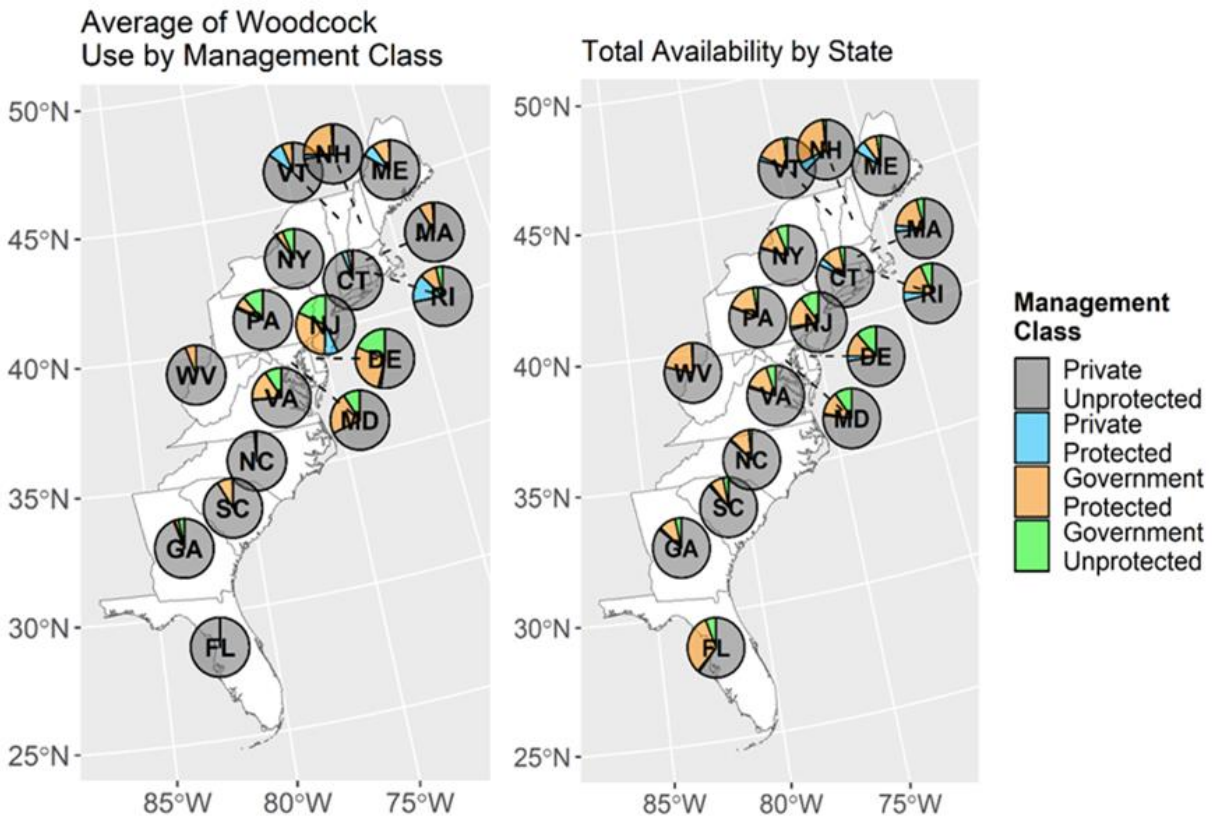


Figure 12. Maps of average woodcock use of each of 4 land ownership/management classes (left panel) and the availability of each class within each state.

2. American Woodcock survival across migratory stages inferred from satellite telemetry data (Lead: Sarah Clements)

Understanding demographic rates, including survival, is fundamental to conservation and management planning for woodcock. However, the variety of behavioral states and the numerous landscapes birds occupy can make survival highly variable throughout the year (e.g., Sillett & Holmes 2002). With mark-recapture or mark-recovery data only, quantifying differences in survival across seasons or stages of the annual cycle can be difficult for migratory species like woodcock. Satellite telemetry data can give us detailed information about bird movements at a fine temporal scale, but device failure or other technological limitations (Hofman et al. 2019) and presumed device effects on birds (Cleasby et al. 2021) can make it difficult to quantify survival from tracking data. We are revisiting and expanding on questions related to woodcock survival explored by Fish (2021) using an updated dataset and different modeling framework that jointly incorporates GPS tag failure and bird survival. Our objectives are to (1) quantify survival rates for woodcock in pre-migration, migration, and post-migration periods; (2) compare survival rates between spring and fall migration, and (3) evaluate how survival differs among age and sex classes.

We used behavioral classifications described above (Berigan et al. in prep) and a joint model, with weekly device failure rates incorporated as a submodel in a Cormack-Jolly-Seber framework (Cormack 1964, Jolly 1965, Seber 1965), which accommodates the probability that a GPS tag continues to function. The weekly true survival of the marked woodcock is modeled in a multistate framework (Kéry & Schaub 2012), where states are associated with pre-migration, migration, and post-migration. We conducted simulation studies to test the bias and precision of the model results on simulated data, which indicated that the model was producing reasonable estimates of weekly survival. We ran separate models for spring and fall migration, and

implemented them in Jags (Plummer 2003). Current model results illustrate that the migratory period is considerably more risky for woodcock, with weekly survival probabilities during fall migration ~ 0.02 lower than during pre- or post-migration (Figure 13).

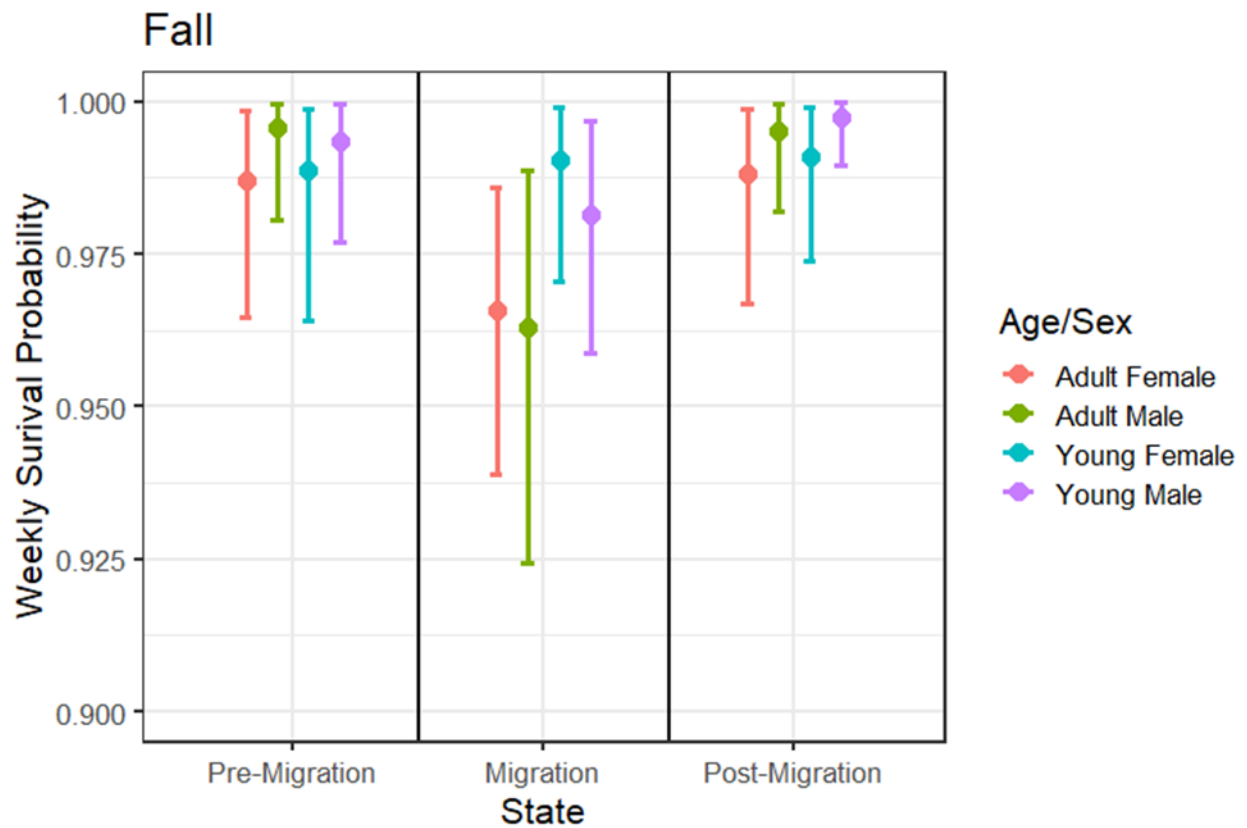


Figure 13. Estimates of weekly fall survival probabilities in the pre-migration, migration, and post-migration periods for fall using GPS point collected between October and January in 2017-2022. Each age/sex class is represented in a different color, and the points show the median of the posterior distribution for each age/sex class. Lines show the 95% credible intervals.

3. Breeding ecology of woodcock in West Virginia (Lead: Kylie Brunette)

In April 2023, working in collaboration with the West Virginia Division of Natural Resources, we initiated a comprehensive study of woodcock breeding ecology in West Virginia. Over the course of three years, our goal was to deploy at least 20 satellite transmitters in each of the state's four ecoregions to track woodcock habitat use during the spring and summer. Through the joint effort of Canaan Valley NWR, Old Hemlock Foundation, WVDNR, and UMaine personnel, we deployed 85 satellite transmitters statewide. The GPS data gathered from these woodcock will inform species distribution models for the breeding period, and will be combined with migratory data from West Virginia in the larger collaborative database. We will use these models to build a spatial decision support tool that managers can use to facilitate habitat management decisions for woodcock within the state.

The second facet of this project focuses on woodcock nesting ecology within West Virginia. A diverse land use history in the state includes surface mining; mine site reclamation provides one avenue for generating the early successional habitat used by nesting woodcock. We are comparing woodcock nesting on sites with a history of surface mining and those that have historically not been mined sites, specifically daily nest survival rates and habitat selection. During 2024 and 2025, we located 30 nests. Preliminary analysis shows that hens select nest sites with greater stem densities, greater percentage shrubby cover, and greater overhead closure, while avoiding sites with greater percentage grassy cover. Nest survival is driven by an interaction of nest age and the density of native saplings (>1–4in dbh), with older nests having lower daily survival rates and increased native sapling density increasing daily survival. Cumulative nest survival was 17.5%. We also monitored nests with remote cameras, capturing predation events and predation attempts by raccoons, fishers, weasels, skunks, opossums, crows, and a Northern Harrier (Figure 14). This work will be the basis for two chapters of Kylie Brunette's dissertation (anticipated graduation May 2028).



Figure 14. A woodcock hen waits until the last second to flush off her nest when a skunk comes sniffing around. The skunk then predated the nest. The hen did try a distraction display but was unsuccessful in defending her clutch.

4. Further evaluating the Singing Ground Survey (Lead: Erik Blomberg)

Two previous studies of satellite-tracked woodcock have evaluated the Singing Ground Survey (SGS). Moore et al. (2019) worked principally in the Central Management Region (CMR) and marked primarily females. Blomberg et al. (2023) used EWMRC data on male woodcock, but was focused primarily in the Eastern Management Region (EMR). Both studies sought to evaluate how the timing of northern terminus of migration aligned with SGS timing and spatial coverage, respectively. Our objective was to use additional GPS tracking data from the CMR to provide additional insights into the SGS in supplement of the findings presented in Blomberg et al. (2023). We asked whether male woodcock migrating to more northern breeding areas in the CMR deviated from patterns observed during the earlier study; specifically, do males in these areas more frequently establish their final residency outside of SGS coverage, or do they migrate during the survey window more frequently. We also used newly available estimates of female woodcock nesting locations (Slezak et al. 2024) to evaluate how the spatial coverage of SGS corresponds with female woodcock nesting distribution. Male woodcock in the CMR migrate later than males in the EMR, particularly in the northernmost survey zone. However, a similar % of male woodcock in the CMR ended their migration within SGS coverage (~90%). While many females nested south of SGS coverage, very few females were identified nesting north of SGS coverage (Figure 15). Overall, these results continue to support the utility of the SGS and its general (although not perfect) alignment with woodcock migration.

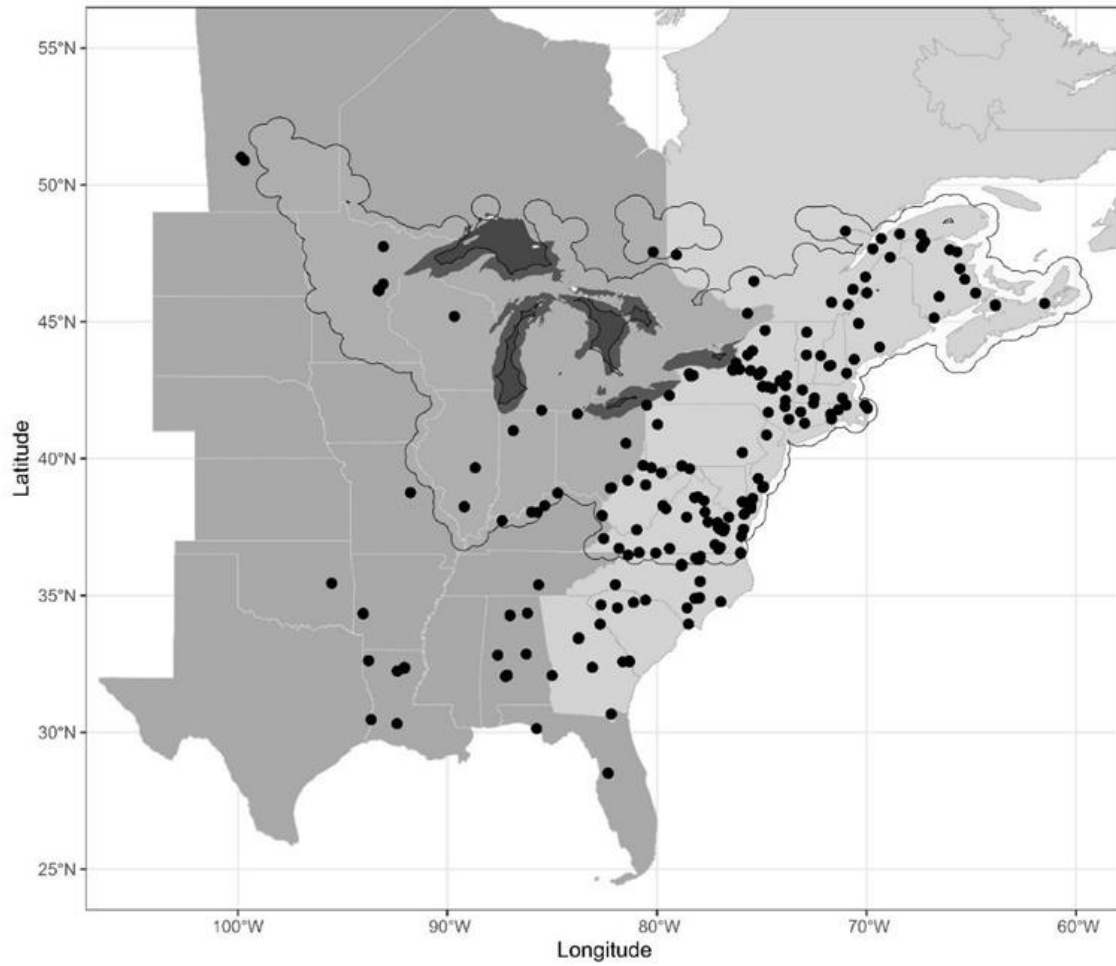


Figure 15. Locations of likely woodcock nests, identified by Slezak et al. (2024), in comparison to the spatial coverage of the American Woodcock Singing Ground Survey.

5. Stable isotope analysis of woodcock feathers (Lead: Rachel Darling)

To evaluate the utility of isotopic predictions of the breeding range of woodcock, we compared isotopic assignment of a selection of our GPS-marked woodcock to their migration and dispersal throughout the Eastern and Central Management Regions. We evaluated feather stable isotope composition for 170 woodcock, specifically focused on hydrogen ($\delta^2\text{H}$). Feather $\delta^2\text{H}$ values are often used to infer the latitudinal origins of migratory birds, given predictable relationship between $\delta^2\text{H}$ and continental precipitation gradients. Feather samples were sent to the Cornell University Stable Isotope Laboratory, where they were washed in 2:1 solution of chloroform:methanol and air dried for at least 24 hours. Vane material from the distal portion of each feather was then removed and packed into silver capsules, and analyzed for $\delta^2\text{H}$ composition via gas pyrolysis in an isotope ratio mass spectrometer. Sample $\delta^2\text{H}$ values were normalized according to established standards following well-developed procedures for analysis of avian feather $\delta^2\text{H}$ (Hobson and Wassenaar 1997).

To assess if the $\delta^2\text{H}$ predicted breeding locations of sampled birds aligned with their GPS data, we calculated each woodcock's northernmost location, and filtered birds to those that attained a stationary state during the breeding/summering months (April – Sept). This allows us to directly compare the isotopic signature of feathers to confirmed summering locations of these birds. We removed woodcock with northernmost locations south of 37°N , as these individuals may not be representative of the greater migratory population. After this filtering, 136 individuals remained. We then followed methods described in Ruegg et al. (2017) to predict $\delta^2\text{H}$ values for feathers using the *gaiah* R package, using a global $\delta^2\text{H}$ isoscape calculated from July precipitation values (waterisotopes.org). We used the $\delta^2\text{H}$ values from 36 of our 136 woodcock as reference values, and calculated the posterior probabilities of origin of the 100 other birds. We summed the posteriors to create a woodcock breeding origin probability surface (Figure 16),

and found the $\delta^2\text{H}$ probability estimates largely aligned with sampled woodcocks' summer GPS locations.

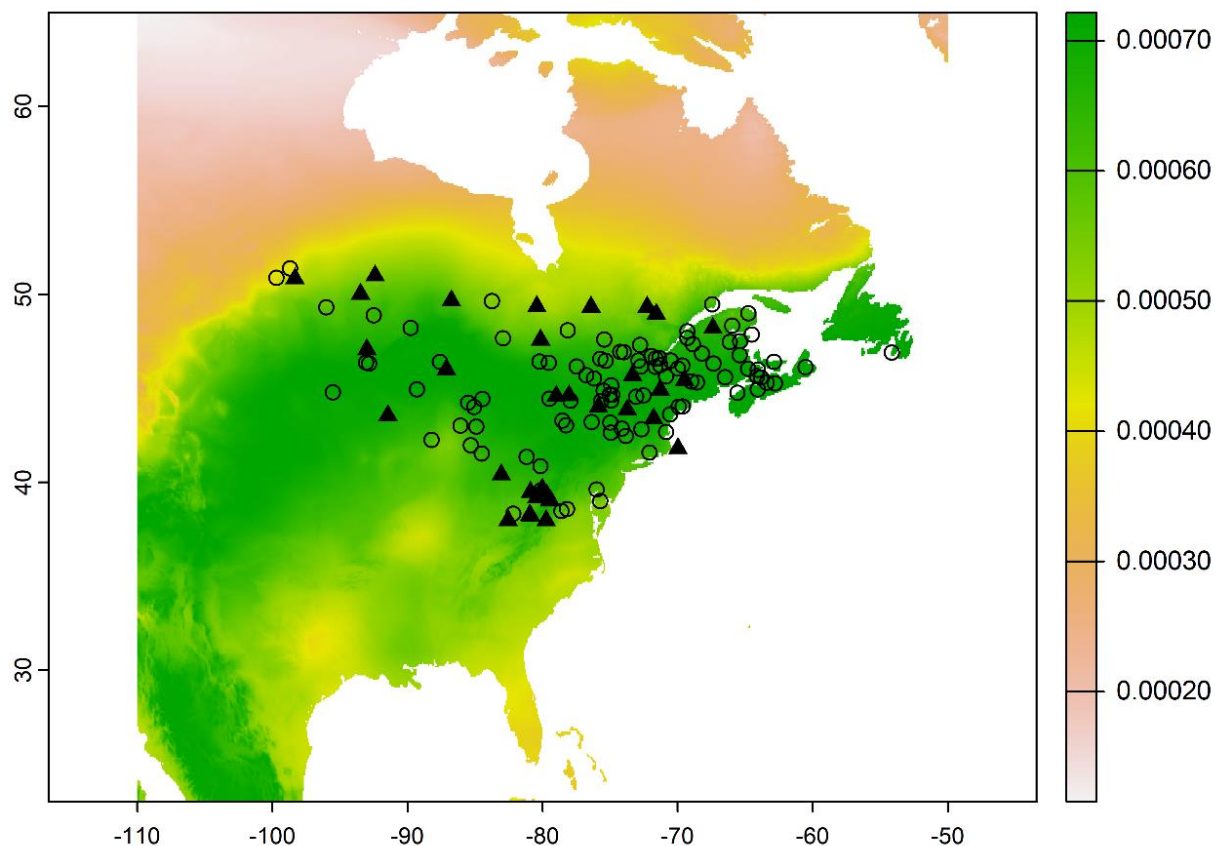


Figure 16. Probability of woodcock breeding origins based on $\delta^2\text{H}$ feather isotope samples and a July precipitation $\delta^2\text{H}$ isoscape (waterisotopes.org). Triangles represent reference woodcocks' summering locations ($n = 36$), and open circles represent woodcock assigned breeding origins by our calculations ($n = 100$). The probability of any one of the assigned woodcock breeding in a location is indicated by color, with green indicating highest probability and white indicating lowest probability.

6. Genomic analysis of population connectivity (Lead: Rachel Darling)

To expand our analysis of migratory connectivity and to better understand how low connectivity may affect population structure, we are evaluating genomic and stable isotopic signatures from blood and feather samples collected from marked woodcock since the beginning of the project. These data provide regional markers to identify at a coarse scale each woodcock's summering location, and in combination with the project's GPS data, determine the frequency that woodcock demonstrate fidelity to natal and/or breeding regions. Our objectives for this work are to 1) conduct a range-wide assessment of population genomic structure for American Woodcock, 2) use genomic signatures and telemetry data from GPS-marked woodcock to identify mechanisms governing population structure, and 3) potentially evaluate evidence for finer-scale population structure within each management region. This work is supported by a grant from the US Fish and Wildlife Service Webless Migratory Gamebird Research fund.

We have processed 320 genomic samples from woodcock. To examine potential population structure, we first identified single nucleotide polymorphisms (SNPs) within the woodcock genome. SNPs are variants in the nucleotide base pairs of DNA (A, G, T or C) that occur in >1% of a species and are used to distinguish between populations or sub-populations of that species. In our first round of genotyping, we created an American woodcock reference genome and were able to isolate 68,067 SNPs from our woodcock samples. Since these samples were sequenced, a high-quality Eurasian woodcock (*Scolopax rusticola*) genome has become available, which we will use to isolate SNPs from our second round of woodcock samples.

A Bayesian clustering analysis was unable to recover any signal of population differentiation from the first batch of samples (Figure 17), including no differences among birds summering (panel A) or wintering (panel B) in the EMR and the CMR, and no spatial structure in

general. This suggests regular gene flow is producing genetic admixture within the global woodcock population; genomics can't distinguish a woodcock breeding in Wisconsin from one breeding in Maine. The first round of samples included many more birds wintering and breeding in the EMR (n=168 and n=143, respectively) than birds wintering and breeding in the CMR (n=49 and n=24, respectively). Our second round of samples includes additional data from migrant woodcock in the CMR, a necessity to improve our inferences. Additional data from birds wintering (n = 10), breeding (n = 3), or spending both seasons (n = 25) in the CMR is forthcoming.

The results from these analyses, as well as analyses of site fidelity during migration and breeding, will be used to inform a range-wide simulation of the woodcock migratory connectivity and population structure, specifically examining the sensitivity of population structure to variation in life history traits. This will be a chapter in Rachel Darling's dissertation (anticipated graduation 2026).

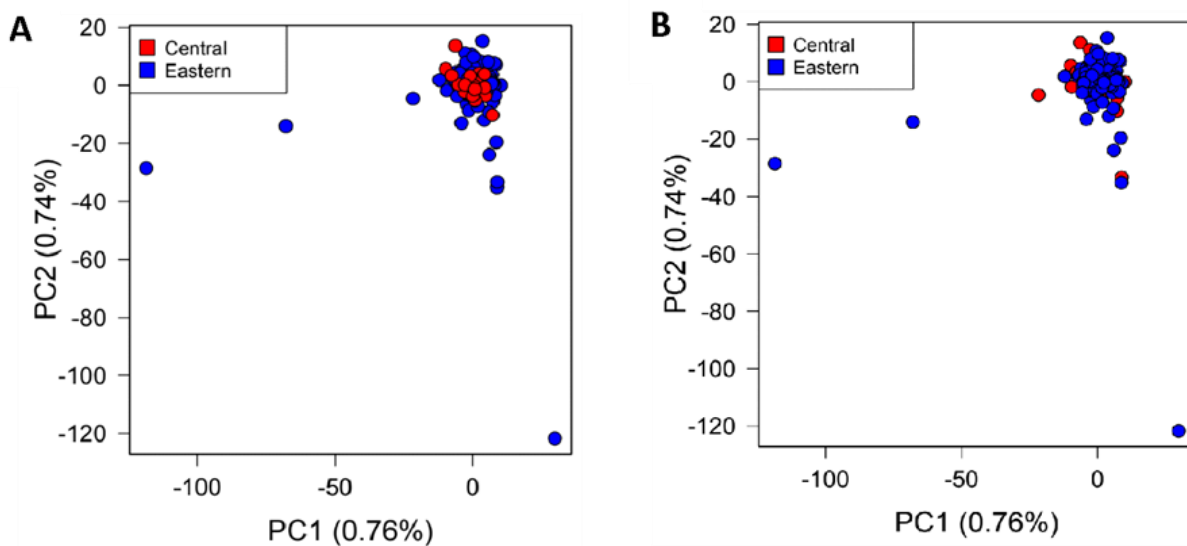


Figure 17. Principal Component Analysis (PCA) results based on (A) summer and (B) winter locations. Locations in the CMR are in red, and locations in the EMR are in blue.

7. Response to light pollution during migration (Lead: Rachel Darling)

There is a growing body of evidence suggesting that light pollution can cause widespread disruption during bird migration, both through local attraction of birds to high intensity light sources (Van Doren et al. 2017) and regional selection of artificially lit areas for migratory stopovers (McLaren et al. 2018). As woodcock are disproportionately the victims of window strikes (Loss et al. 2020), they are believed to be especially vulnerable to light pollution. We leveraged our dataset GPS-tagged woodcock and the New World Atlas of Sky Brightness (Falchi et al. 2016a & Falchi et al. 2016b) to examine the relationship between woodcock migratory stopover selection and night light. We ran step selection functions by migratory season and age-sex class and compared the approximate level of light each bird encountered as it initiated each stopover with light levels at random steps along the bird's migration trajectory. Preliminary analyses (Figure 18) show that in the spring, adult males ($n = 83$) select for night light ($\beta = 0.15 \pm 0.06$, odds ratio of 1.16), and in the fall, young females ($n = 35$) select for night light ($\beta = 0.18 \pm 0.09$, odds ratio 1.19). All other age-sex class relationships with night light were not significant. Next steps in this analysis include adding covariates, such as landcover, and running step selection functions on within-stopover movements. This will be a chapter in Rachel Darling's dissertation (anticipated graduation 2026).

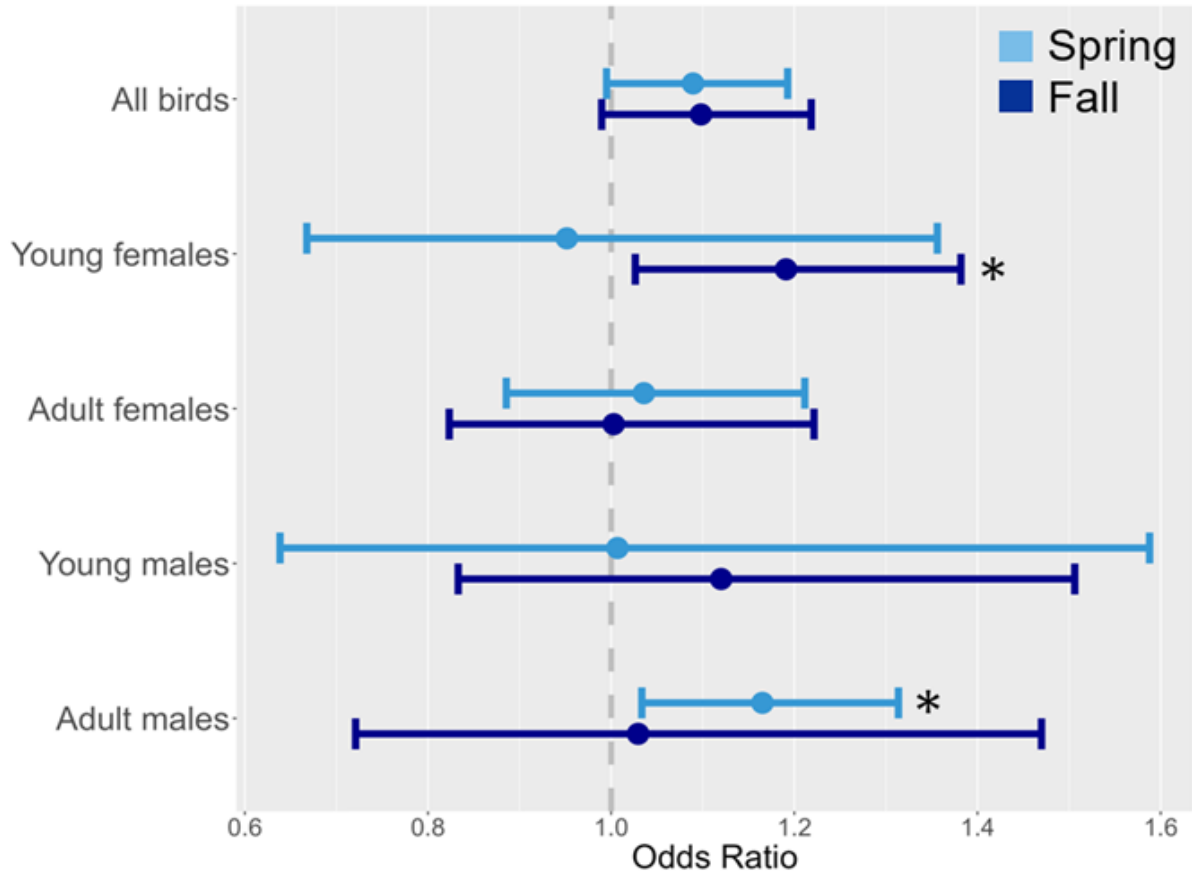


Figure 18. The odds ratios that a woodcock will choose an area with more light over an area with less light, by age-sex class and season. Spring is represented by light blue, fall by dark blue. Asterisk indicates $p < 0.05$.

Outreach

Our primary means of distributing information is the EWMRC email listserv, which includes 76 members representing 25 states, provinces, federal agencies, and non-governmental organizations engaged in woodcock conservation. We also use our website to distribute up-to-date woodcock migration information to any interested parties. Since it was launched, the website has gained a considerable following (>95,000 unique visitors, >340,000 page views), and we have also incorporated interactive Shiny apps to allow users to interface with our migratory data and hopefully drive more traffic. PDFs of our published studies are available on the research page of our website.

Our data have also been incorporated into a number of national databases, including the National Audubon Society's Bird Migration Explorer (explorer.audubon.org), which is an educational resource for learning about North American bird migration, connectivity, and conservation. Additionally, the Cornell Lab of Ornithology has used our data to validate BirdFlow (<https://birdflow-science.github.io/>), an R package that uses eBird data to predict bird migration. We have contributed data to the Shorebird Science and Conservation Collective, (Harrison et al. in press), an initiative housed within the Smithsonian's National Zoo and Conservation Biology Institute which collates and provides shorebird tracking data to conservation practitioners. Through the shorebird Collective, EWMRC data have contributed to conservation projects in Minnesota, the Canadian Maritimes, and offshore wind assessments by the U.S. Fish and Wildlife Service and Environment and Climate Change Canada.

EWMRC personnel also presented project results in outreach settings in 2025, including the Penobscot Valley Chapter of the Maine Audubon Society and introducing undergraduates at the University of Maine to woodcock survey and capture methods. Finally, we continue to present our results at wildlife and ornithology conferences, including the annual meeting of the American Ornithological Society in St. Louis, Missouri in August 2025, the Atlantic Flyway

Technical Section and Council meeting in Wells, Maine in September 2025, and the Maine Chapter of the Wildlife Society meeting in Orono, Maine in December 2025. A full list of outreach and professional presentations using EWMRC data since the beginning of the project is provided below.

EWMRC Output to Date

Peer-reviewed publications (see [our website](#) for pdfs)

Fish, A. C. and 16 coauthors. 2026. Seasonal, age-, and sex-related differences in use of external migratory cues by American Woodcock (*Scolopax minor*). Ibis.

<https://doi.org/10.1111/ibi.70042>

Berigan, L., and 27 coauthors. 2025. Low migratory flight altitudes may explain increased collision risk for American Woodcock. Ornithological Applications.

<https://doi.org/10.1093/ornithapp/duaf017>

Slezak, C.R., I.M. Delmonico, J.E. Kilburn, S.R. McWilliams. 2025. Mismatch between strong nest-site selection and low survival of nests and broods for *Scolopax minor* (American Woodcock) and its implications for conservation. Ornithological Applications 127:1-15.

<https://doi.org/10.1093/ornithapp/duaf009>

Slezak, C.R., D. Bakner, S.R. McWilliams. 2025. High post-breeding survival for male American woodcock based on long-term tracking: a case study from Rhode Island, USA. Wildlife Society Bulletin 2025: e1591. <https://doi.org/10.1002/wsb.1591>

Harrison, A.L. and 67 coauthors. 2024. The collective application of shorebird tracking data to conservation. Conservation Biology. <https://doi.org/10.1111/cobi.70194>

Clements, S. and 27 coauthors. 2024. Satellite tracking of American Woodcock reveals a gradient of migration strategies. Ornithology. <https://doi.org/10.1093/ornithology/ukae008>

Slezak, C. and 26 coauthors. 2024. Unconventional life history strategies in a migratory shorebird; decoupling reproduction and migration. Proceedings of the Royal Society B: Biological Sciences. <https://doi.org/10.1098/rspb.2024.0021>

Fish, A. C. and 20 coauthors. 2024. American woodcock (*Scolopax minor*) fall and spring migration phenology in Eastern North America: implications for hunting season timing. *Journal of Wildlife Management*. <https://doi.org/10.1002/jwmg.22565>

Blomberg, E. J., and 25 coauthors. 2023. American woodcock singing ground survey largely conforms to the phenology of male woodcock migration. *Journal of Wildlife Management*. <https://doi.org/10.1002/jwmg.22488>

Slezak, C., R. Masse, S.R. McWilliams. 2023. Sex-specific differences and long-term trends in habitat selection of American Woodcock. *J. Wildlife Management* e22518 <https://doi.org/10.1002/jwmg.22518>.

Student theses and dissertations

Links to manuscripts at the end of the citation.

Filkins, K. 2024. Landscape use and resource selection during the breeding season and migration for American woodcock (*Scolopax minor*) in New York State. M.S. Thesis, SUNY-Brockport. [Thesis](#).

Slezak, C. 2024. Habitat Selection and Breeding Ecology of American Woodcock in Eastern North America. PhD Dissertatin, University of Rhode Island. [Dissertation](#).

Berigan, L. 2024. Full annual cycle analysis of American Woodcock (*Scolopax minor*) distribution, habitat use, and migration ecology. PhD Dissertation, University of Maine. [Digital Commons](#).

Pavlik, Z. 2024. Does urbanization around stopping sites affect migratory behavior in American woodcock (*Scolopax minor*). Honors Thesis, University of Maine. [Digital Commons](#).

Trebilcock, K. 2022. Riders on the storm: using satellite transmitters to quantify American woodcock movement behavior following extreme weather events. Honors Thesis, University of Maine. [Digital Commons](#).

Fish, A. 2021. American woodcock (*Scolopax minor*) migration ecology in eastern North America. PhD Dissertation, University of Maine. [Digital Commons](#).

Professional presentations

Brunette, K. Nest survival and habitat associations of American Woodcock on reclaimed surface mines in West Virginia. Maine State Chapter of the Wildlife Society Winter Research Symposium, Orono, Maine. December 2025.

Brunette, K. Nest survival and habitat associations of American Woodcock on reclaimed surface mines in West Virginia. Fall Atlantic Flyway Technical Section and Council Meeting, Wells, Maine. September 2025.

Brunette, K. Nest survival and habitat associations of American Woodcock on reclaimed surface mines in West Virginia. American Ornithological Society Annual Meeting, St. Louis, Missouri. August 2025.

Darling, R. American woodcock strategies for overwater flight across the Gulf of Maine during fall migration. American Ornithological Society Annual Meeting, St. Louis, Missouri. August 2025.

Darling, R. American Woodcock Migration Relative to Offshore Wind Development. Maine State Chapter of the Wildlife Society Fall Meeting, Orono, Maine. December 2024.

Filkins, K. American woodcock (*Scolopax minor*) research update. New York State Department of Environmental Conservation Upland Gamebird Team Meeting, Virtual. September 2024.

Berigan, L. Examining individual variation in American Woodcock habitat selection throughout the full annual cycle. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.

Blomberg, E. The American Woodcock Singing Ground Survey largely conforms to the phenology of male woodcock migration. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.

Brunette, K. Habitat associations of American Woodcock on reclaimed surface mines in West Virginia. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.

- Clements, S. Satellite tracking of American Woodcock reveals a gradient of migration strategies. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.
- Darling, R. Troubled waters: assessing American woodcock over-water migration in relation to offshore wind energy development. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.
- Slezak, C. Unconventional life-history in a migratory shorebird: desegregating reproduction and migration. Western Hemisphere Shorebird Group Annual Meeting, Sackville, New Brunswick. August 2024.
- Filkins, K. Sex specific landscape use of American woodcock (*Scolopax minor*) during breeding season in New York State. Northeast Natural History Conference, Albany, NY. April 2024.
- Blomberg, E. The American Woodcock singing ground survey largely conforms to the phenology of male woodcock migration. Maine State Chapter of the Wildlife Society Fall Meeting, Orono, Maine. December 2023.
- Filkins, K. A comparison of resource selection methods for American woodcock that breed in New York State. Rochester Academy of Science Conference, Rochester, NY, October 2023. (poster).
- Berigan, L. Adapting hidden Markov movement models to the study of migration by small-bodied birds. American Ornithological Society and Canadian Society of Ornithologists Joint Conference, London, Ontario, Canada, August 2023.
- Blomberg, E. The American Woodcock signing ground survey largely conforms to the phenology of male woodcock migration. American Ornithological Society and Canadian Society of Ornithologists Joint Conference, London, Ontario, Canada, August 2023.
- Clements, S. Lack of discrete migration strategies in American Woodcock suggests potential for species resiliency. American Ornithological Society and Canadian Society of Ornithologists Joint Conference, London, Ontario, Canada, August 2023 (poster).
- Darling, R. American woodcock select for areas of artificial light at night during migration. American Ornithological Society and Canadian Society of Ornithologists Joint Conference, London, Ontario, Canada, August 2023. (poster).

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- Filkins, K. American woodcock (*Scolopax minor*) resource selection in New York State. Northeast Fish and Wildlife Conference, Hershey, PA, April 2023.
- Berigan, L. Using joint life-stage-specific species distribution models to facilitate habitat conservation for American woodcock. Maine Chapter of the Wildlife Society Annual Fall Meeting, December 2022 (poster).
- Slezak, C.R. "Almost itinerant", the breeding ecology of a peculiar shorebird, the American woodcock, The Wildlife Society Annual Conference, 2022.
- Filkins, K. American woodcock (*Scolopax minor*) research update. New York State Department of Environmental Conservation Upland Gamebird Team Meeting, Virtual, September 2022.
- Berigan, L. Revisiting the role of stopover when assessing migratory connectivity: an American Woodcock case study. American Ornithological Society, Puerto Rico, 2022.
- Berigan, L. Site prioritization for American Woodcock management by comparing breeding and migratory habitat distribution models. The Wildlife Society Annual Conference, 2021.
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- Fish, A. Migratory ecology of American Woodcock (*Scolopax minor*) in eastern North America. American Ornithological Society Annual Conference, June 2019.
- Blomberg, E. American woodcock migration ecology in the Eastern Region: a large-scale collaborative effort. Eastern Bird Banding Association Annual Conference. Winter Harbor, ME, June 2018.

Blomberg, E. American woodcock migration ecology in the Eastern Region: a large-scale collaborative effort. 11th American Woodcock Symposium. Roscommon, MI, October 2017.

Blomberg, E. American woodcock migration ecology in the Eastern Region: a collaborative approach. Northeastern Upland Gamebird Technical Committee Meeting. Winter Harbor, ME, September 2017.

Blomberg, E. American woodcock migration ecology in the Eastern Region: a collaborative approach. Atlantic Flyway Council Fall Meeting. Annapolis, MD, August 2017.

Outreach presentations

- R. Darling delivered a public presentation to the Penobscot Valley Chapter of the Audubon Society, titled “Fall Migration over the Gulf of Maine and the American Woodcock (part 2!)”. June 2025.
- R. Darling delivered a public talk on EWMRC research at the Maine Audubon Fields Pond nature center, and led a woodcock walk to observe courtship displays. April 2025.
- R. Darling delivered an online talk to the South Carolina Chapter of the Ruffed Grouse Society, titled “Migration, Habitat, and Populations: studying woodcock with the Eastern Woodcock Migration Research Cooperative”. August 2024.
- R. Darling delivered a public talk to the Penobscot Valley Chapter of the Audubon Society, titled “Fall migration over the Gulf of Maine and the American woodcock”. June 2024.
- K. Filkins gave a virtual presentation on her work and the EWMRC for the Berkshire Natural Resources Council, April 2024.
- E. Blomberg delivered 2 public talks on EWMRC research at the Maine Audubon Fields Pond nature center, and led a woodcock walk to observe courtship displays. April 2023 and 2024.
- E. Blomberg presented 3 updates on EWMRC research at the Central Maine Chapter of the Ruffed Grouse Society Annual Banquet in Brewer, Maine, November 2019, 2022, 2023.

- L. Berigan delivered a public talk to Downeast Audubon titled “Migratory Marvels: Understanding Woodcock and Golden-winged Warbler Migration” in April 2023.
- L. Berigan delivered a public talk to the Harris Center for Conservation Education titled “What can woodcock teach us about bird migration?” in May 2022.
- L. Berigan delivered a public talk to Friends of Missisquoi National Wildlife Refuge & Green Mountain Audubon Society titled “Meet the Timberdoodle!” in April 2022.
- E. Blomberg presented an online talk on EWMRC research for the National Ruffed Grouse Society organization, August 2022.
- E. Blomberg presented a talk on EWMRC research at the 2020 National conference of the North American Versatile Hunting Dog Association in Portland, ME. January, 2020.

Press coverage

- E. Blomberg was interviewed for an article in *Modern Huntsman* magazine titled “Where to do birds go” which covered woodcock migration ecology.
- A. Roth was interviewed as part of a *Project Upland* podcast discussing itinerant woodcock and their earthworm diets.
- C. Slezak was interviewed as part of a *Project Upland* podcast discussing itinerant breeding in woodcock.
- The EWMRC was referenced on *The Meat Eater* podcast during a discussion by Karl Malcom (RGS/AWS) about American woodcock and ruffed grouse population status.
- Sara Cerv (RGS/AWS) was featured on *The Upland Social* podcast to discuss woodcock migration and habitat.
- E. Blomberg and K. Brunette were interviewed for the radio show *West Virginia Outdoors* to discuss EWMRC research in West Virginia. June 2025.
- R. Darling was interviewed by the Nova Scotia Federation of Agriculture, [“Farmland - An Expected, Yet Important Habitat for an Elusive Migratory Bird”](#). Mar. 2025.
- E. Blomberg, A. Roth, K. Brunette and R. Darling were interviewed and the EWMRC was featured in a [UMaine research article](#), also picked up by [Phys.org](#). Nov. 2024.

- C. Slezak was featured as a U.S. Fish and Wildlife Scholar. [Colby Slezak and the American woodcock](#). Nov. 2024.
- C. Slezak was interviewed by The Nature Conservancy regarding woodcock itinerant breeding. [Tracking Down the American Woodcock](#). Nov. 2024.
- A. Roth and E. Blomberg were interviewed for “Notes from the Field: American Woodcock Migration.” *USGS Bird Banding Lab*. [Available Online](#). 24 May 2024.
- E. Blomberg wrote an article for the Ruffed Grouse Society’s Covers magazine, “Satellite Tracking and the Science of Woodcock Migration”. [Available Online](#). 24 May 2024.
- C. Slezak and S. McWilliams were interviewed and EWMRC itinerant breeding chapter was [featured in Audubon Magazine](#), April 2024 issue.
- C. Slezak’s research was featured by the University of Rhode Island. [URI-led team finds direct evidence of ‘itinerant breeding’ in East Coast shorebird species](#). 17 April 2024
- Project Upland magazine profiled our research in an article on Woodcock migration. <https://projectupland.com/woodcock-hunting/understanding-the-fall-woodcock-migration/>. October 2023.
- E. Blomberg and C. Slezak were interviewed and EWMRC research was featured in *Project Upland Magazine*, Spring 2023 issue.
- EWMRC research was [featured by the U.S. Fish and Wildlife Service as an example of the impact of the Wildlife and Sport Fish Restoration Program](#).
- Project Upland magazine profiled EWMRC research in a species’ profile article. <https://projectupland.com/woodcock-hunting/unusual-facts-about-american-woodcock/>. August 2022.
- E Blomberg was interviewed for the web podcast *Her Upland* to discuss EWMRC research using GPS transmitters. July 2021
- The Canadian Broadcast Company (CBC) [featured EWMRC migration research](#). September 2020.
- E. Blomberg was interviewed for the web podcast *Project Upland* to discuss EWMRC research using GPS transmitters. <https://projectupland.com>. January 2019.

Awards

- 2025 Best Article/Journal Paper - presented in 2025 by The Wildlife Society to C. Slezak for “Unconventional life history strategies in a migratory shorebird; decoupling reproduction and migration” in Proceedings of the Royal Society B.
- Wildlife Restoration Award – The Wildlife Society. This award was presented to the Eastern Woodcock Migration Research Cooperative for significant contributions to wildlife conservation stemming from use of Federal Aid in Wildlife Restoration funds. November 2021.

Project Partners

Alabama Department of Conservation and
Natural Resources

American Woodcock Society

Association des Savaginaires du Saguenay-Lac-
St-Jean

Atlantic Flyway Council

Auburn University, Alabama

Audubon Vermont

Canaan Valley National Wildlife Refuge

Club des Becassiers du Quebec

Environment and Climate Change Canada

Florida Fish and Wildlife Conservation
Commission

Friends of the 500th

Friends of Missisquoi National Wildlife Refuge

Georgia Department of Natural Resources

Louisiana Department of Wildlife and
Fisheries

Maine Department of Inland Fisheries and
Wildlife

Maine Outdoor Heritage Fund

Maryland Department of Natural Resources

Missisquoi National Wildlife Refuge

Moosehorn National Wildlife Refuge

The Nature Conservancy in Vermont

New Jersey Dept of Environmental Protection

New York Department of Environmental
Conservation

Nemours Wildlife Foundation

North Carolina Wildlife Resources Commission

Old Hemlock Foundation

Pennsylvania Game Commission

Penobscot Valley Chapter of the Maine
Audubon Society

Rhode Island Department of Environmental
Management

Ruffed Grouse Society

Silvio O. Conte National Wildlife Refuge

State University of New York - Brockport

State University of New York - Cobleskill

South Carolina Department of Natural
Resources

Timberdoodle Habitat Society

USFWS National Wildlife Refuge System

USFWS Office of Migratory Birds

USFWS Webless Migratory Game Bird
Research Program

US Forest Service

USGS - Patuxent Wildlife Research Center
University of Maine

University of Rhode Island

Vermont Fish & Wildlife Department

Virginia Department of Wildlife Resources

West Virginia Division of Natural Resources

West Virginia Highlands Conservancy

Wildlife Management Institute

Wildlife and Sport Fish Restoration Program

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Appendices

Additional Tables

Table A1. American Woodcock captured and tagged with satellite GPS transmitters in each state/province collaborating in the Eastern Woodcock Migration Research Cooperative, summarized by year, age, and sex.

State	Year	Male			Female			Unknown	Total
		Young	Adult	Unk	Young	Adult	Unk	Unk	
Alabama	2020	1	2		2	2		7	
	2021		2		2	2		6	
	2022	5	3		1	1		10	
Florida	2021	1	3		1			5	
	2022	2	4					6	
Georgia	2020	3	3		1	5		12	
	2021	1	3		2	5		11	
Louisiana	2022	4	4		3	5		16	
	2023	4	11		1	1	1	18	
	2024	14	8		9	5	24	60	
	2025	6	4		5	6		21	
Maine	2017	4				2		6	
	2018	1	1		3	2		7	
	2020	1	2			3		6	
Maryland	2018		1		3			4	
	2019		3		5	2		10	

State	Year	Male			Female			Unknown	Total
		Young	Adult	Unk	Young	Adult	Unk	Unk	
Maryland	2020	1	3		4	1			9
	2021	3	3		1	1			8
New Jersey	2018	7			8				15
	2019	8			9				17
New York	2018	4	1		1	3			9
	2019	4	6		11	9			30
	2022				5	5			10
	2023	2	3		2	3			10
North Carolina	2019	2	2			2			6
	2020	7	1		4	3			15
	2021	6	1		1	2			10
	2022	5	2		1	7			15
Nova Scotia	2019	3			4				7
	2022	4	1						5
	2023	4	1						5
	2024	8	7		5	3			23
Ontario	2018		1			1			2
	2019	1			1	1			3
Pennsylvania	2018	1	4		3	4			12
	2019	3	1		1	7			12
	2020	3	2		1	7			13
	2021	5	2		2	3			12

State	Year	Male			Female			Unknown	Total
		Young	Adult	Unk	Young	Adult	Unk	Unk	
Quebec	2018	2			2	1			5
	2019	5			2	3			10
	2020	2	1		1	3			7
	2021				2	2			4
	2022	2			1				3
Rhode Island	2018		12			3			15
	2019		12			2			14
	2020				7	7	3		17
	2021				3	12			15
South Carolina	2019	2	1		4	2			9
	2020	2	3		2	1			8
	2021	2	4		1				7
	2022						1		1
	2023					1			1
Virginia	2018		5		3	1			9
	2019	10	9		11	13		3	46
	2020	15	5	1	7	16			44
	2021		1		1	2	1	4	9
	2022						2		2
Vermont	2020	8	5		3	2			18
	2021	3	1		2	4			10

State	Year	Male			Female			Unknown	Total
		Young	Adult	Unk	Young	Adult	Unk	Unk	
Vermont	2022		2		1	3	1		7
	2023		1						1
West Virginia	2019	2	1		1				4
	2020				1				1
	2023	5	13		1	2			21
	2024	24	8		1				33
	2025	13	14		2	1			30
Wisconsin	2023	1			1				2
	2024		1						1
Total		233	187	1	162	184	8	32	807

Table A2. Migration records of GPS-tagged American Woodcock tagged from Fall 2024 through Spring 2025. Additional data collected during this time period from birds tagged in Winter and Spring of 2024 is also included (bolded IDs).

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
<i>Louisiana</i>					
LA-2024-34	1/9/2024	Female	SY	54	Cypress
LA-2024-35	1/9/2024	Female	SY	52	Cypress
LA-2024-37	1/10/2024	Female	ASY	49	USACE
LA-2024-39	1/10/2024	Female	SY	52	USACE
LA-2024-44	1/10/2024	Male	ASY	61	USACE
LA-2024-45	1/9/2024	Male	SY	51	Cypress
LA-2024-49	1/9/2024	Male	SY	67	Cypress
LA-2024-54	1/10/2024	Male	SY	62	USACE
LA-2024-55	1/10/2024	Male	SY	57	USACE
LA-2024-56	1/10/2024	Male	ASY	54	USACE
LA-2024-61	1/10/2024	Male	SY	54	USACE
LA-2024-62	1/10/2024	Unk	SY	62	USACE
LA-2024-66	1/11/2024	Female	SY	66	Cypress
LA-2025-94	1/2/2025	Male	SY	24	Tallulah
LA-2025-95	1/2/2025	Male	ASY	111	Tallulah
LA-2025-96	1/2/2025	Male	SY	122	Tallulah
LA-2025-97	1/2/2025	Male	ASY	116	Tallulah
LA-2025-98	1/2/2025	Male	SY	118	Tallulah

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
LA-2025-99	1/2/2025	Female	ASY	142	Tallulah
LA-2025-100	1/2/2025	Female	SY	124	Tallulah
LA-2025-101	1/2/2025	Female	SY	130	Tallulah
LA-2025-102	1/2/2025	Female	SY	142	Tallulah
LA-2025-103	1/4/2025	Male	SY	122	Tallulah
LA-2025-104	1/4/2025	Male	SY	52	Tallulah
LA-2025-105	1/4/2025	Female	ASY	130	Tallulah
LA-2025-106	1/4/2025	Female	SY	18	Tallulah
LA-2025-107	1/4/2025	Female	SY	134	Tallulah
LA-2025-108	1/4/2025	Female	ASY	132	Tallulah
LA-2025-109	1/15/2025	Male	SY	16	Tallulah
LA-2025-110	1/15/2025	Female	ASY	140	Tallulah
LA-2025-111	1/15/2025	Male	ASY	100	Tallulah
LA-2025-112	1/15/2025	Female	ASY	136	Tallulah
LA-2025-113	1/15/2025	Male	ASY	112	Tallulah
LA-2025-114	1/16/2025	Female	ASY	116	Tallulah

Nova Scotia

NS-2024-17	10/2/2024	Female	AHY	142	Elderbank
NS-2024-18	10/2/2024	Male	AHY	130	Elderbank
NS-2024-19	10/4/2024	Female	AHY	113	Elderbank
NS-2024-20	10/4/2024	Male	AHY	95	Elderbank

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
NS-2024-21	10/4/2024	Male	AHY	120	Elderbank
NS-2024-22	10/5/2024	Female	HY	22	Elderbank
NS-2024-23	10/6/2024	Male	HY	0	PValley
NS-2024-24	10/8/2024	Male	HY	121	Elderbank
NS-2024-25	10/9/2024	Male	AHY	50	PValley
NS-2024-26	10/10/2024	Female	HY	129	PValley
NS-2024-27	10/10/2024	Male	AHY	134	Elderbank
NS-2024-28	10/8/2024	Female	HY	127	Elderbank
NS-2024-29	10/10/2024	Female	HY	4	Elderbank
NS-2024-30	10/11/2024	Male	HY	74	PValley
NS-2024-31	10/11/2024	Male	HY	64	PValley
NS-2024-32	10/12/2024	Male	AHY	35	PValley
NS-2024-33	10/12/2024	Male	AHY	128	PValley
NS-2024-34	10/13/2024	Male	HY	54	Elderbank
NS-2024-35	10/13/2024	Male	HY	123	Elderbank
NS-2024-35	10/16/2024	Male	HY	123	Elderbank
NS-2024-36	10/13/2024	Male	HY	138	Elderbank
NS-2024-37	10/16/2024	Female	AHY	127	PValley
NS-2024-38	10/16/2024	Female	HY	70	Elderbank
NS-2024-39	10/22/2024	Male	HY	0	Elderbank

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
<i>West Virginia</i>					
WV-2024-29	4/22/2024	Male	SY	36	SLWMA
WV-2024-30	4/22/2024	Male	SY	41	SLWMA
WV-2024-31	4/22/2024	Male	SY	53	SLWMA
WV-2024-32	4/23/2024	Male	SY	43	SLWMA
WV-2024-34	4/24/2024	Male	SY	38	Canaan
WV-2024-39	4/24/2024	Male	ASY	54	Little Indian Creek
WV-2024-41	4/24/2024	Male	SY	66	Little Indian Creek
WV-2024-42	4/24/2024	Male	SY	64	Little Indian Creek
WV-2024-44	4/25/2024	Male	SY	68	Canaan
WV-2024-45	4/25/2024	Male	ASY	44	Canaan
WV-2024-46	4/25/2024	Male	SY	65	Little Indian Creek
WV-2024-47	4/25/2024	Male	ASY	41	Little Indian Creek
WV-2024-48	4/25/2024	Male	SY	55	Little Indian Creek
WV-2024-51	5/2/2024	Male	SY	54	Canaan
WV-2024-52	5/2/2024	Male	ASY	32	Canaan
WV-2024-53	5/8/2024	Male	SY	41	Little Indian Creek
WV-2024-54	5/8/2024	Male	ASY	57	Little Indian Creek
WV-2024-55	5/8/2024	Male	SY	52	Little Indian Creek
WV-2024-58	5/15/2024	Male	SY	39	Little Indian Creek
WV-2025-59	4/28/2025	Male	SY	12	Ryan Family Farm
WV-2025-60	4/28/2025	Male	ASY	38	Ryan Family Farm
WV-2025-61	4/29/2025	Male	SY	28	Scherr

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
WV-2025-62	4/29/2025	Male	SY	8	Walnut Bottom
WV-2025-63	4/29/2025	Female	SY	6	Walnut Bottom
WV-2025-64	4/30/2025	Female	ASY	15	Allegheny WMA
WV-2025-65	4/30/2025	Male	ASY	29	Allegheny WMA
WV-2025-66	4/30/2025	Male	SY	39	Allegheny WMA
WV-2025-67	4/30/2025	Male	ASY	35	Allegheny WMA
WV-2025-68	4/30/2025	Male	ASY	36	Forbes Property
WV-2025-69	4/30/2025	Male	SY	36	Forbes Property
WV-2025-70	5/5/2025	Male	ASY	24	SLWMA
WV-2025-71	5/5/2025	Male	ASY	4	SLWMA
WV-2025-72	5/5/2025	Male	SY	22	SLWMA
WV-2025-73	5/5/2025	Male	SY	28	SLWMA
WV-2025-74	5/5/2025	Male	SY	36	SLWMA
WV-2025-75	5/5/2025	Male	ASY	31	SLWMA
WV-2025-76	5/5/2025	Male	ASY	42	SLWMA
WV-2025-77	5/6/2025	Male	SY	40	WV Lowe's
WV-2025-78	5/6/2025	Male	ASY	40	WV Lowe's
WV-2025-79	5/6/2025	Male	SY	42	SLWMA
WV-2025-80	5/6/2025	Male	ASY	0	WV Lowe's
WV-2025-81	5/7/2025	Male	AHY	34	Muddlety
WV-2025-82	5/7/2025	Male	ASY	28	Muddlety
WV-2025-83	5/7/2025	Male	SY	38	Muddlety

Bird ID	Capture Date	Sex	Age at Capture^a	No. Loc^b	Location of Capture^c
WV-2025-84	5/7/2025	Male	SY	26	WV Lowe's
WV-2025-85	5/7/2025	Female	SY	34	WV Lowe's
WV-2025-86	5/8/2025	Male	ASY	35	Jordan Run
WV-2025-87	5/8/2025	Male	SY	40	Jordan Run
WV-2025-88	5/13/2025	Male	AHY	40	Snake Hill WMA

^aAge at capture reflects whether the bird was in its first molt cycle (HY or SY) or had adult plumage (AHY or ASY). ^bThe number of GPS locations that each bird recorded during that migratory season. Certain birds may record less or more points than others, depending on the programmed duty cycle, size of the GPS battery, and occasional mortality during GPS tracking. Bolded bird IDs successfully transmitted locations in more than one season. ^cFurther capture location details can be found in EWMRC shared google drive, "American Woodcock Migration Project Resources" > folder American Woodcock Data > Excel file Master_AMWO_database, sheet Deployment_Site_Inventory.

Additional Figures: GPS location maps

Figures A1 – A6. Maps showing American Woodcock movements in Fall 2024 and Spring 2025, and subsets of birds that recorded more than one migratory season. White points represent GPS locations and each colored path represents an individual bird.

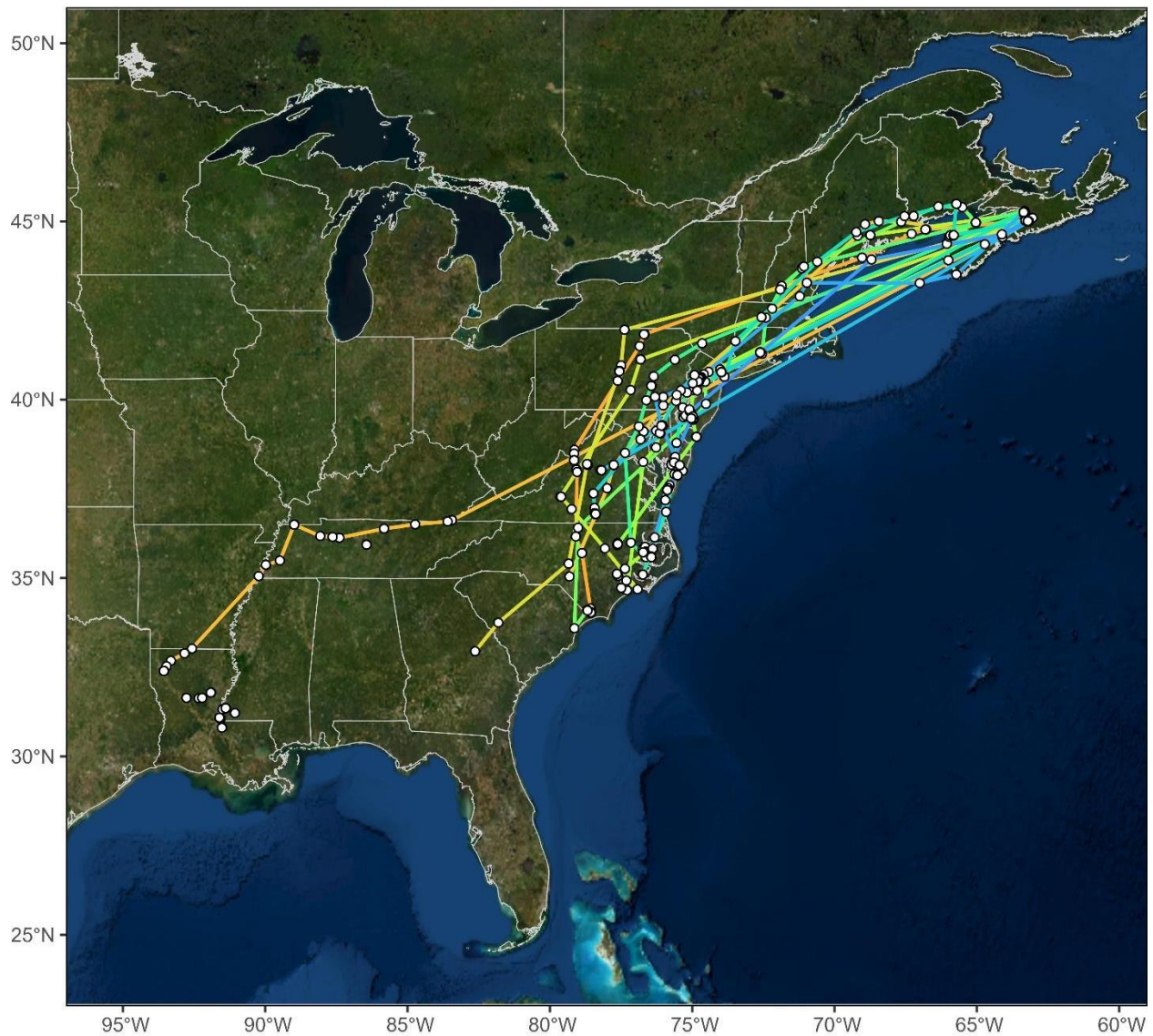


Figure A1. Fall 2024 migratory movements and stationary locations from all tagged woodcock.

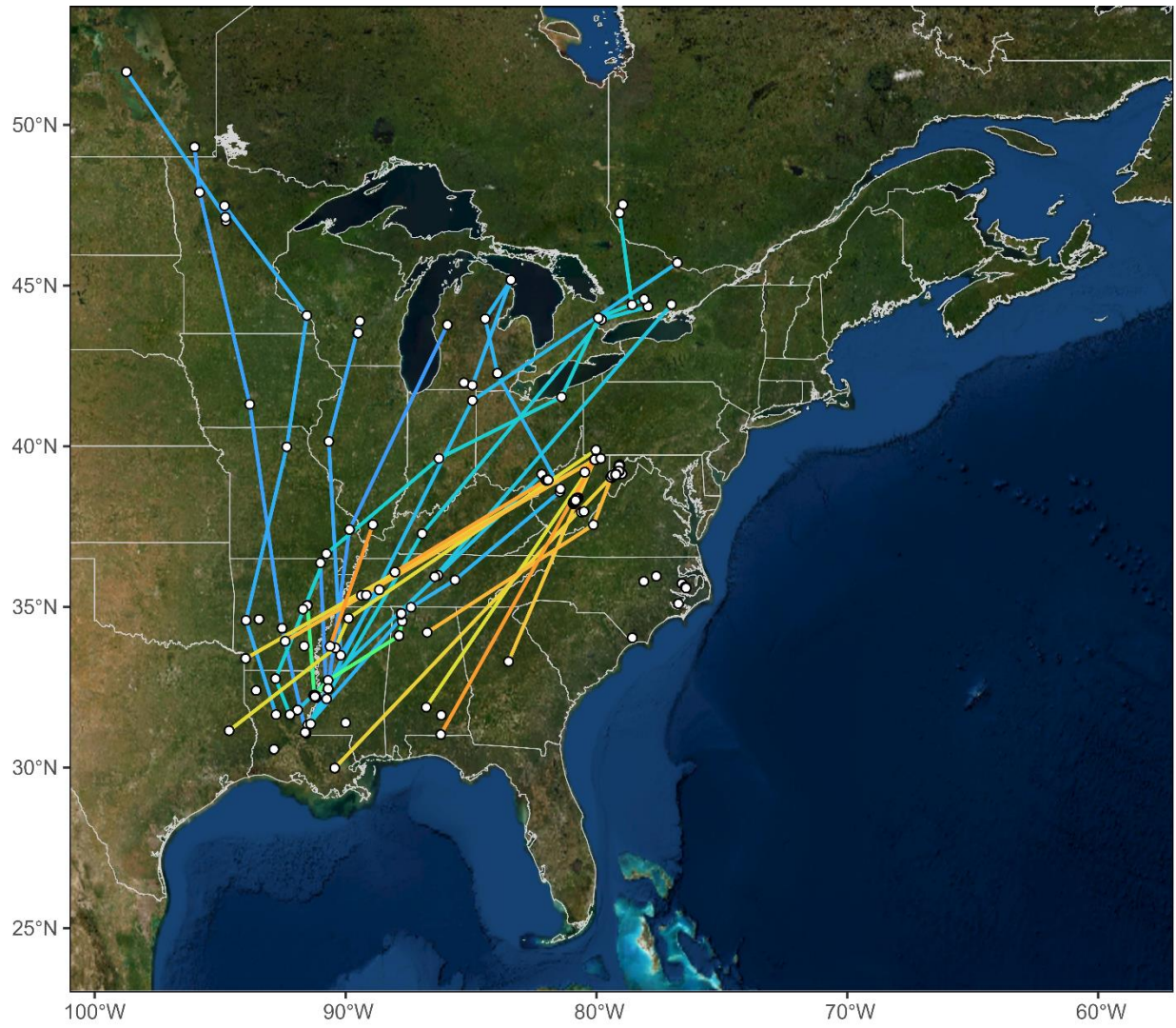


Figure A2. Spring 2025 migratory movements and locations from all tagged woodcock.

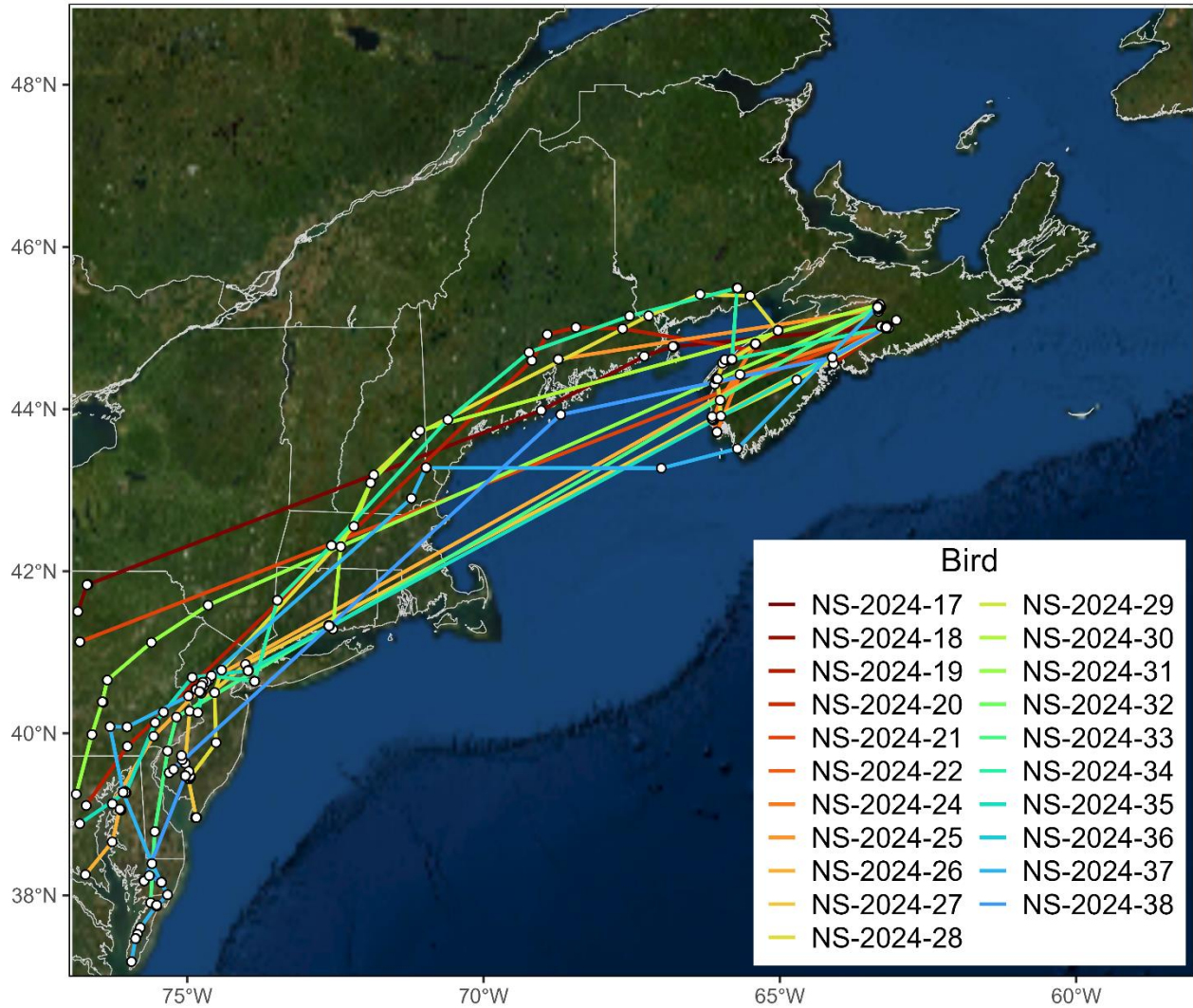


Figure A3. Close-up of Gulf of Maine region, demonstrating overwater crossings of birds tagged in Nova Scotia in Fall 2024. Note that several birds seem to fly straight across the Gulf without recording any points (orange and green tracks) – these birds left the province before the nightly schedule activated, and thus a track is drawn between their last point in the province and their first point in the US, often somewhere in New Jersey or other mid-Atlantic states.

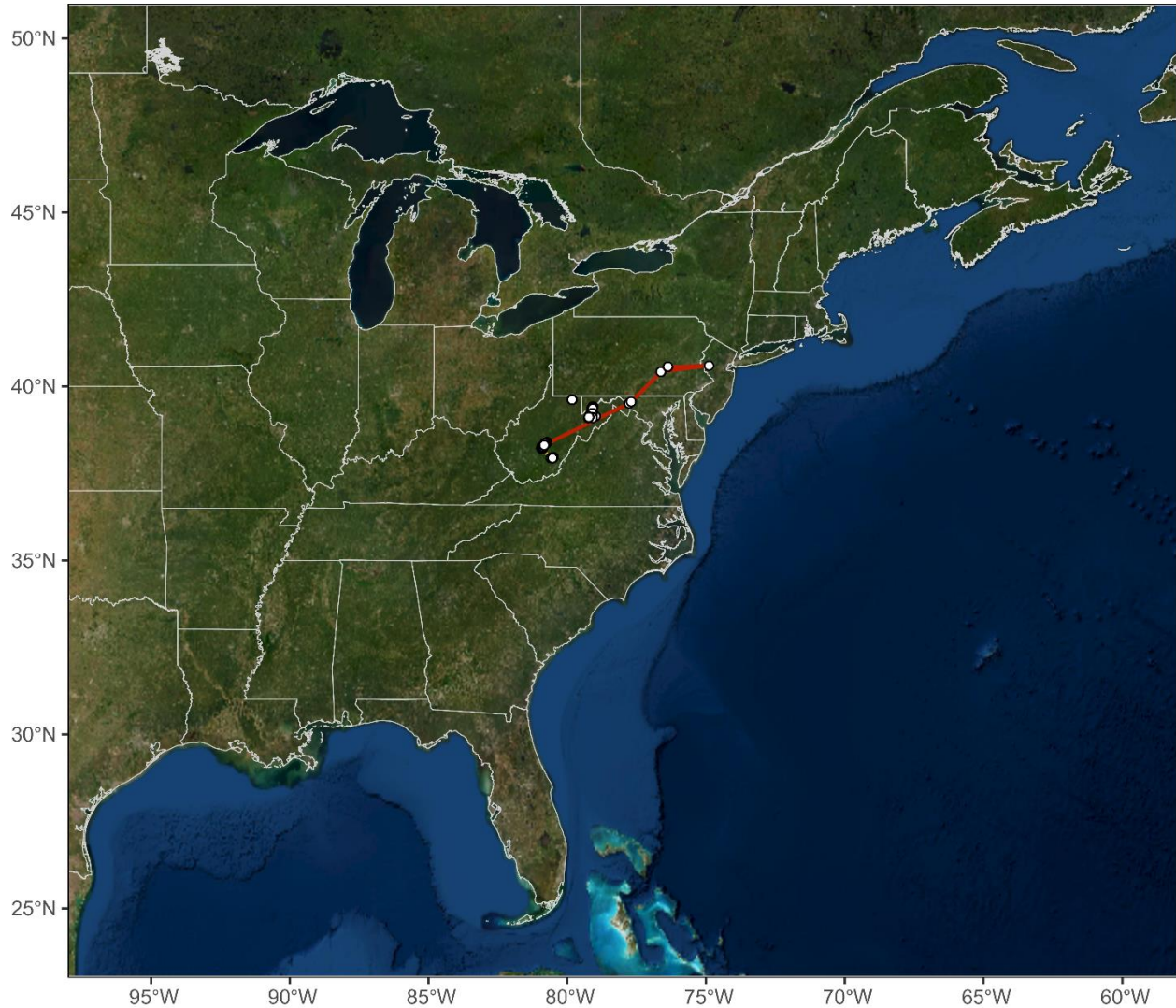


Figure A4. All movements of woodcock tagged in West Virginia in Spring 2025. Similar to last year, these birds were tagged during the breeding season and most did not move from their tagging locations (excepting a summertime jaunt by WV-2025-85, the red track). Their tags were programmed with a Lazarus schedule again, and hopefully will come online again briefly in February 2026, and then again in mid-April 2026. If you are interested in their more local movements, head to our website's Research page and peruse the West Virginia 2025 annual report.

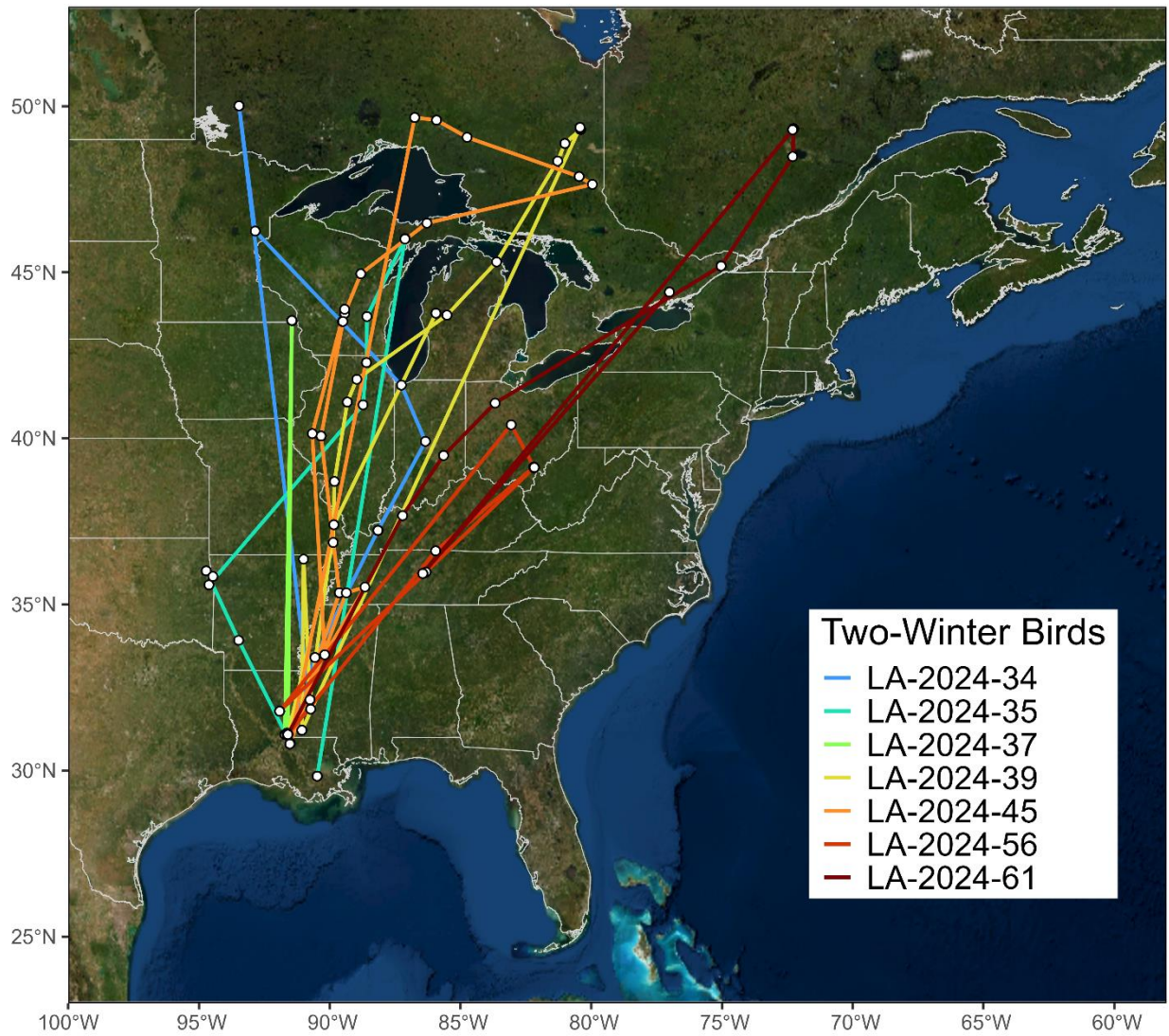


Figure A5. All movements of ‘Lazarus’ schedule birds tagged in Louisiana in January 2024 that returned locations in the 2024-2025 winter season.

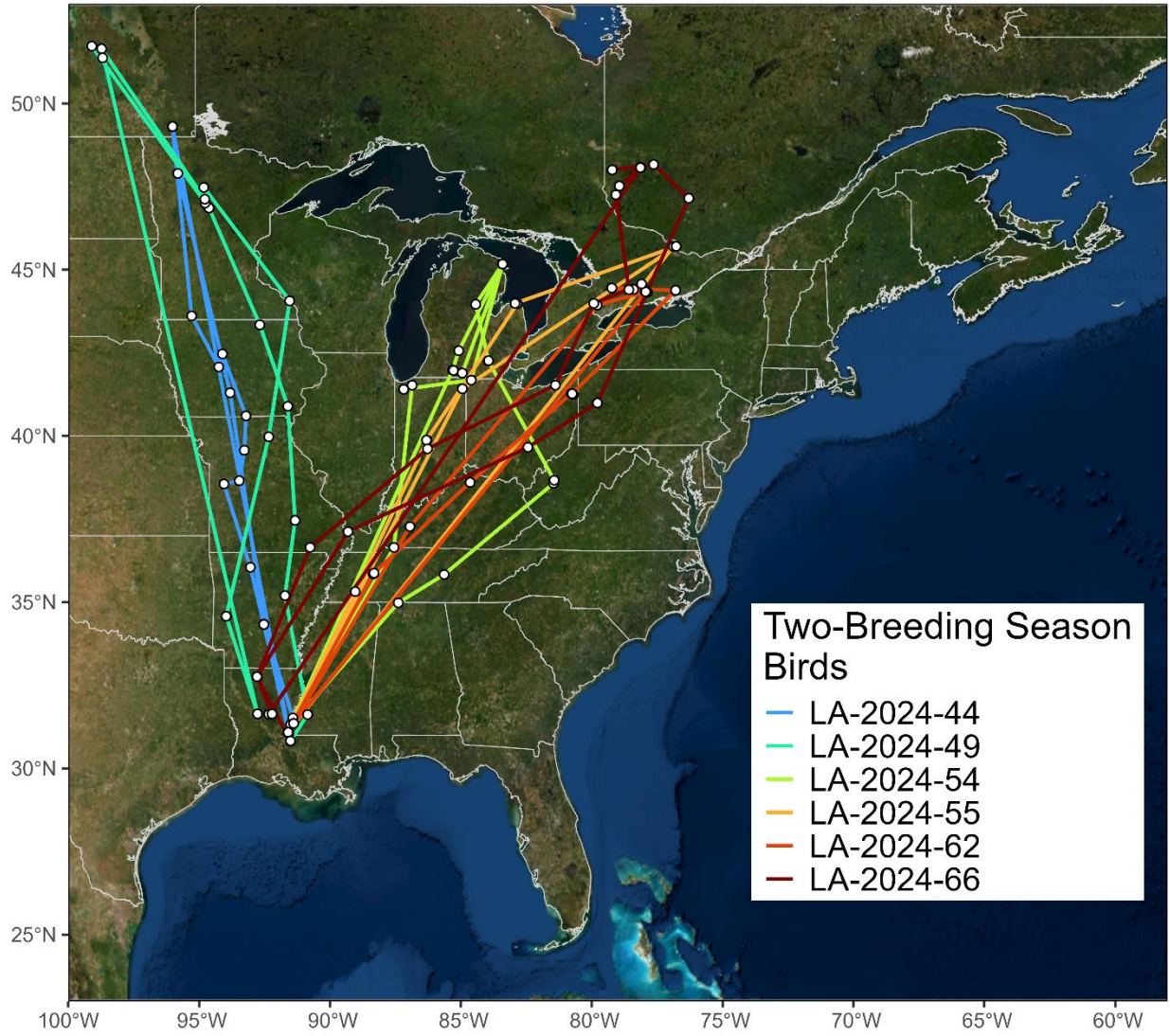


Figure A6. All movements of ‘Lazarus’ schedule woodcock tagged in Louisiana in January 2024 that recorded locations in the 2024 and 2025 breeding seasons.

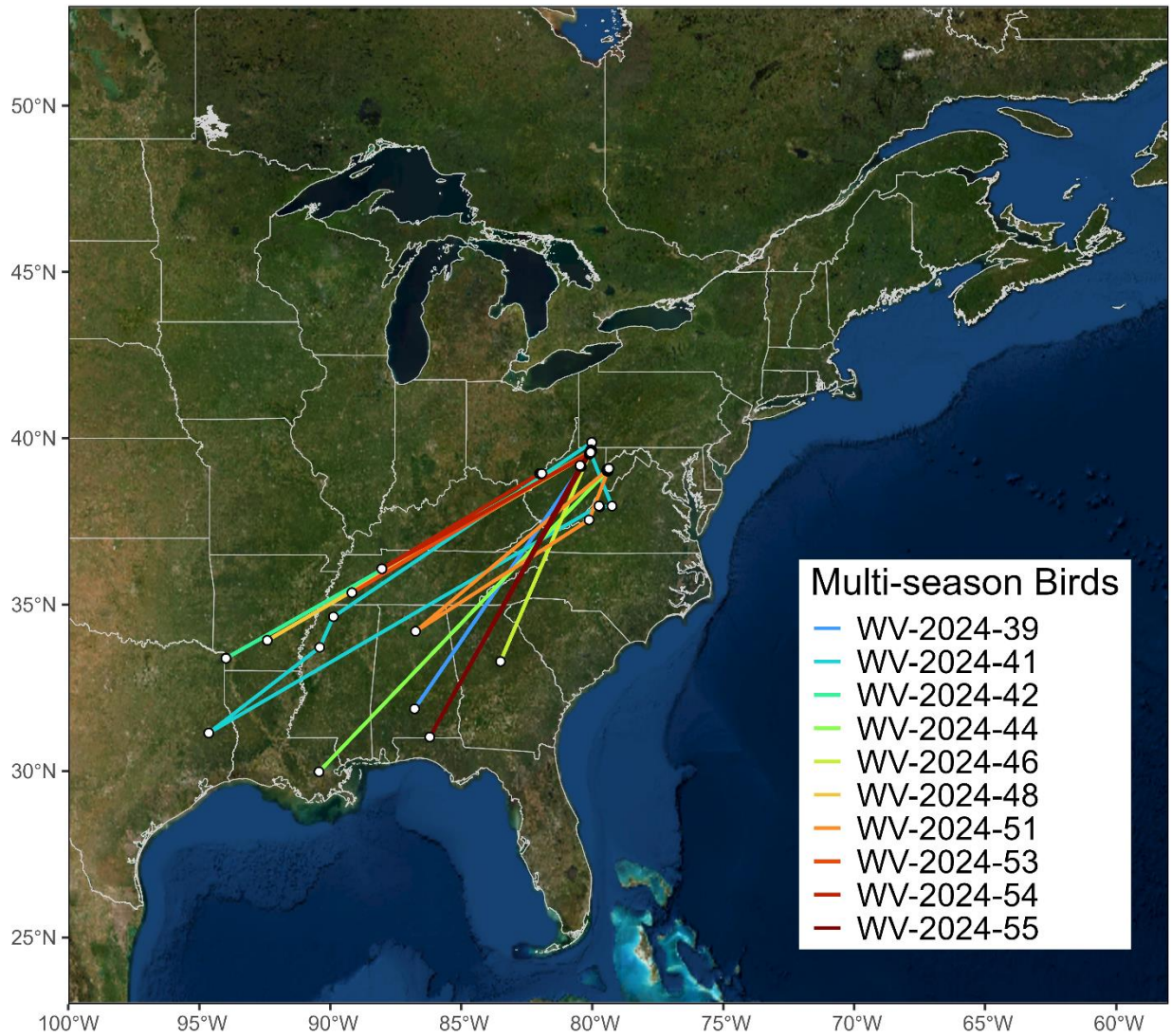


Figure A7. All movements of ‘Lazarus’ schedule woodcock tagged in West Virginia in Spring 2024, demonstrating their February 2025 wintering locations and their return to West Virginia by April 2025.