*Thank you to the editor and reviewers for your thoughtful feedback on the manuscript. Editorial and reviewer feedback is in bold, responses are in normal text, and quotations from the manuscript are italicized.*

**AE comments:  
Thank you for submitting a new version of your manuscript. I appreciate all the work that went into these revisions and think you have done an excellent job addressing issues raised during the previous review. I especially appreciate your willingness to run the analyses again after re-parameterizing the model. I believe that these changes will help to address questions about model assumptions and ensure that inferences based on these analyses are accurate and reliable.**

Thank you.

**As you’ll see, the paper was evaluated by two new reviewers, both of whom saw value in the work and think that the paper will make a strong contribution to the literature. Each of the reviewers provided thorough and detailed suggestions that will help to clarify aspects of the methods and improve readability. Reviewer 1 has requested that additional information about sample sizes, potential biases, flight locations, and GPS data be provided. I think that sample sizes could be provided in Table 1 of the main text (see my comment below), while some of the other information (e.g., a map with flight locations) could be provided in supplementary materials.**

We have added sample sizes as a part of the requested reworking of Table 1 and have added a map of potential and likely flight locations to the supplementary materials (Figure S1).

**Given the substantial improvements to your manuscript, I have only a few minor comments beyond those provided by the two reviewers:  
  
Line 87: It is unclear what “early” spring migration is for woodcocks. I would suggest starting this paragraph with a brief overview of woodcock ecology and migration patterns to provide context for readers less familiar with the species.**

We have added the following text to the introduction:

*p. 4*

*American Woodcock (Scolopax minor) are an upland species of Scolopacid distributed throughout eastern North America. They are among the earliest avian migrants in spring (February–May) and the latest migrants in fall (October–December), likely timing their migration based on the availability of earthworms, which are their preferred prey (Fish et al. 2024, Berigan 2024, McAuley et al. 2020).*

**Like Reviewer 1, I think that Tables 1 and 2 should be reorganized so that results for each season, age, and sex are presented in different rows of the table. I would also suggest adding sample sizes (i.e., the estimated number of flights associated with each group) as a column in Table 1. Then you could have a column for each metric (mean, median, SD, skewness), where each cell contains an estimate and a CRI in parentheses.**

We have reformatted Tables 1 & 2 with each row corresponding to a model/group, and each column corresponding to a metric. We have also added sample sizes to Table 1.

**I realize that you added estimates of the standard deviation and skewness for distributions to Table 1 in response to comments from previous reviewers. However, I am not convinced that it will be useful to the reader to have these additional metrics, particularly when there is no discussion about the shape of these distributions in the text nor is there information provided about how to interpret skewness (which will be less familiar to the average reader). If you feel it is important to provide estimates for all of the metrics in Table 1, then please provide information about skewness in the text and Table caption and provide a description of how these parameters relate to the distribution of flight altitudes as shown in Fig. 2. Alternatively, I think that skewness (and potentially SD) could be removed from Table 1 and put in supplementary materials.**

We have moved skewness and SD metrics to the supplementary materials, which creates more room for sample sizes in Table 1.

**Figure 1: It is difficult to see the 50% CRIs. I would suggest removing them or making the point (median) smaller so the 50% CRI is easier to see.**

We have revised this figure to remove the 50% credible intervals.

**Reviewer #1: This manuscript, Low migratory flight altitudes may explain increased collision risk for American Woodcock, examined flight altitudes of woodcock during migration and compared those estimates to man-made objects that pose a risk of collision for birds. I appreciated reading the manuscript and commend the authors for their efforts. I especially appreciated the method they used to identify flight points, understand measurement error, and describe the distribution of the flight altitudes. I do think that there are a few places where the manuscript could be improved. Specifically, there is missing information regarding the GPS data and sample sizes (see comments below). I also think that the paper would benefit from a map showing the distribution of the GPS data that the authors collected. It occurred over a very broad area, so a map would help the reader better understand where the data were collected and where the flight points were recorded. Given the low sample size per bird, I think that this is really important to include.**

We have addressed your comments regarding sample sizes below. We have also added a map of potential and likely flight locations to the supplementary materials (Figure S1).

**I found it difficult to evaluate the validity of the results given the lack of information on sample sizes within the main text. I see that there is a table in the SI that shows the estimated number of GPS points, but many readers will not refer to the SI and there is no indication about how many birds (the real sample size) are represented by those points nor how those individuals are spread across the different seasons, age classes, or sexes. Please include both the number of birds and the number of GPS points when reporting statistics about the different groups. I think that it would be sufficient to report the Estimate without the credible interval within the main text, but please add the number of individuals to Table S1 or create a similar table.**

We have reworked Table 1 to include sample sizes for each model and group, including the number of individuals, number of GPS locations, and estimated number of those GPS locations which are flight locations. We elected to retain the credible intervals for the estimated number of flight locations, as we believe that it’s important to remind the reader that this is a derived parameter.

**Can you also please add a statement or two about potential biases or issues with the data you collected. There was a total of 258 potential migratory locations for 106 birds, which is only about 2.4 points per bird. If only 144 of those are distributed equally among those 106 birds, then that is only 1.4 points per bird. Or were there a few birds with lots of flight points? Also, weather, topography, and land cover (all things that influence flight behavior) are highly variable across the range where birds were captured - are those flight points evenly distributed across that area or concentrated? How far did the birds move during migration? Were the flight points collected only at the beginning of migration or throughout migration?**

The potential for bias would exist if we relied heavily on points from a single individual, or points from a certain geographic area. The maximum number of likely flight locations (>50% probability of being recorded in flight) which we obtained from a single individual was 6, and our flight locations were fairly evenly distributed throughout the eastern portion of the woodcock’s range. We have added a map of our flight locations to the supplemental material (Figure S1), along with the following language to alleviate some of these concerns for our readers.

*Supplementary material, p. 2*

*Likely flight locations are those identified by the base model as having >50% chance of being recorded during a nocturnal migratory flight. Seventy-nine individual birds recorded likely flight locations (median: 2 points per bird, range 1–6).*

**I also was not fond of the organization of the tables and found them difficult to follow. I suggest reorganizing them (like Table S1) so that the metrics are all listed in the same line across the top so that they each have their own columns and each group (spring, fall, juvenile, adult, etc.) are listed on separate rows. Please also include a column for estimated sample sizes for the number of birds and the number of GPS locations for each group within that larger table.**

We have reorganized Tables 1 & 2 into a format resembling Table S1. We have also included sample sizes as a part of Table 1.

**Table and figure captions need to include where the study took place and the time frame. They should stand alone and be understandable without the text of the manuscript.**

We have added the geographic location of the study and the time frame to all figure and table captions.

**Specific comments:  
L5-6 - since the title doesn't include anything about weather radar, mentioning it here is not really important. I suggest deleting the statement after the semi-colon.**

Done.

**L7 - We have been measuring flight altitudes since GPS was opened to the public by the US government in 2000 and we could measure them on birds flying at night. The recent advances are linked to the weight of the birds, not to when they migrate. Given that, I suggest changing nocturnal to birds of small body mass.**

We have changed this sentence to the following:

*p. 1*

*Recent advances in satellite tracking technologies allow quantifying use of low altitudes by small migrating birds with a high level of precision, allowing species-level inference into potential collision risk based on flight altitude.*

**L8 - what is a "risky" altitude? I suggest changing this to "based on flight altitude"**

Done.

**L17 - are these mean altitudes above sea level or ground level? Please add ASL or AGL in as appropriate.**

Added “above ground level”.

**L32 - capitalize woodcock**

Done.

**L53 - change rotor sweep to rotor swept zone, which is commonly used when talking about wind turbines**

Done.

**L61 - add flight in front of altitude**

Done.

**L63 - delete bird**

Done.

**L64 - GPS-GSM transmitters and GPS data loggers are also frequently used. I suggest removing satellite.**

Done.

**L66 - change size to mass**

Done.

**L81 - change collision and mortality risk to collision-related mortality risk**

Done.

**L92 - 106 - there are several sentences in this paragraph that need to be changed to past tense**

We have changed these sentences to past tense.

**L118 - change "where juveniles were" to "where we defined juveniles as"**

We’ve rewritten this sentence as follows:

*p. 5*

*We aged and sexed birds upon capture, where we classified birds undertaking their first fall and spring migrations as juveniles, and all other birds as adults.*

**L116 - do the units actually have an altimeter or did you use the GPS reported altitude? I was not aware nor could I find an option for a pinpoint GPS unit with an altimeter. If it actually had an altimeter sensor, then you might want to add a statement that says the units were custom-designed with an altimeter sensor. Otherwise remove the word altimeter.**

We have removed the word altimeter and instead refer to our altitude readings as GPS-derived altitude.

**L109-119 - somewhere in this paragraph you need to report what measurements a pinpoint GPS provides, e.g., latitude, longitude, altitude, etc. Please describe the specific type of altitude measurement the GPS provides - some provide mean ASL, others altitude above the ellipsoid. The type matters because the measurements are not the same and require different methods for estimating altitude AGL (see Poessel et al 2018). Also, does the GPS provide measurements of precision, HDOP, PDOP, and/or VDOP? What about speed? How were the data retrieved? Sent via Argos or was there some other method? Please provide more details.**

We have added the following text to the methods:

*p. 6*

*Transmitters recorded time, latitude, longitude, and GPS-derived altitude above the WGS84 ellipsoid, and transmitted data back to the ARGOS satellite constellation after every third location.*

**L126- this is not a very useful citation for the elevation layer you used. It needs to include the origin of the elevation layer - e.g., National Elevation Dataset, SRTM, and the resolution - 30 m, 90 m?**

We have changed the description of this layer to “ESRI composite elevation layer”, as this layer is drawn from multiple sources. The composite nature of this layer makes the resolution variable across the layer’s extent, although pixel size is generally between 1 and 10m within the woodcock’s range.

**L126 - change height to altitude; height refers to the difference between the top and bottom of an object, whereas altitude refers the vertical distance of an object above a surface.**

Changed to altitude.

**L127 - this is unclear - what does computational tractability mean? I don't understand how scaling between 0-1 allows you to describe flight altitudes? Why specifically did you do this? Please clarify.**

We have moved this sentence from the data collection to the modeling section, and rewritten it as follows:

*p. 9*

*As Bayesian models often perform better with scaled variables, we scaled our estimated flight altitudes between 0 and 1 for modeling, and back-transformed all parameter estimates into meters above ground level for evaluation.*

**L170 - 172 - the font here is different from the rest of the main text**

The font of this section had inadvertently been switched to Cambria Math. This has now been fixed.

**L186 - change height to altitude**

Done.

**L210 - change rotor sweep to rotor swept zone**

Done.

**L219 - add above ground level after "median flight altitude"**

Done.

**L220 - 225 - you need to include sample sizes (both birds and GPS locations) for these. Sample sizes should also be included in Tables 1 and 2.**

We have added sample sizes, including number of individuals, GPS locations, and estimated number of flight locations to Table 1. For reasons outlined in the response to L226, we have elected not to add this information to Table 2.

**L223 - change are to were**

Changed throughout the paragraph.

**L226 - throughout this paragraph add n-birds and n-GPS**

As exposure to obstacles is treated as a derived parameter in the model (i.e. estimated from the shape of the log-normal distribution) there is not an equivalent sample size metric like we have in Table 1. We have rewritten the *Comparison of flight altitudes to weather radar and airspace obstacles* section of the methods, the caption for Table 2, and this paragraph of the results to make it clearer that these are derived parameters.

**L229 - add within rotor swept zone of wind turbines**

Substituted “within the rotor swept zone of wind turbines” for “at wind turbine altitude”.

**L230 - Don't start a sentence with a number - this should be spelled out**

Done.

**L265 - add above ground level after altitudes**

Done.

**L280 - add "to fly at" before lower**

Substituted “fly at” for “choose”.

**L285 - jet streams can have very high wind speeds and occur at very high altitudes 25-35,000 feet. I think that you are referring to low-level jets, which form at night and occur at much lower altitudes and have lower maximum wind speeds. These are the jets that might support nocturnal migration. Please change jet stream to low-level jet.**

We appreciate the clarification and have made the requested change.

**L286 - To what seasonal differences are you referring? Please explain.**

We’ve rewritten the sentence as follows:

*pp. 16–17*

*Due to lower flight altitudes in fall, woodcock are more likely to fly at altitudes coinciding with wind turbines (31% vs. 25% of altitudes) and communication towers (61% vs. 52%) in fall than spring.*

**L290 - 296 - could weather influence this? Are there more low visibility nights because of southerly flow and higher humidity during spring? Maybe just indicate that there could be other weather-related factors that might influence their flight behavior and collision risk.**

We have rewritten the final sentence of this paragraph as follows:

*p. 19*

*Other factors, such as seasonal weather (Loss et al. 2020) or male display behavior in the spring (McAuley et al. 2020) could be alternative drivers for seasonal differences in building collision rates.*

**Reviewer #2: I am a de novo reviewer so I reviewed this manuscript with fresh eyes. I also reviewed the response to prior reviews and I am satisfied with the author responses, particularly as they relate to the queries raised by the previous reviewer 1. I am satisfied with how they responded to the query about a modest sample size and the assumption that diurnal locations are always on the ground. Switching to 1300-1500 seems like a valid assumption and it allows the reader to judge the appropriateness of this decision. I also liked the switch from a Gaussian to a student t distribution, the addition of the mixture model, the change to a log-normal distribution on the priors, the modification to Table 1, and the new sensitivity analysis.**

Thank you.

**The authors will see, however, that one of their responses about basing the results on hidden Markov models was still confusing and not adequately described. I've marked this on my annotated file with copy edits.**

We have rewritten this section to state the following:

*p. 6*

*We subset these locations to include only those within the migratory classification dataset produced by Berigan (2024). This dataset classified individual locations as migratory or non-migratory based on the assumption that migration starts after the first >16.1km movement and ends after the final >16.1km movement of the season.*

**I found the comment by reviewer 1 about removing the citation to their work rather inappropriate and had I been the associate editor (I was an AE for the AOS for 13 years) on this manuscript, I would have stricken that comment from the review before it went back to the authors. Indeed, as reviewer 1 stated, it was "a bit out of line". In fact, it was very much out of line. I apologize to the authors that this directive was given to them in the first place. Reviewers don't get to pick and choose how their work (or their competitor's work) is cited unless the citation is mischaracterizing their work. I thought the authors handled this appropriately with their decision to modify the sentence, even though they should have never been asked to do so in the first place.  
  
Overall, this manuscript is well written and reflects the excellent feedback from the AE and two reviewers. Other than what I've written above, I have no real additional constructive feedback to offer. Almost all of my comments are editorial.**

Thank you**.**

**Copy Edits  
  
Please remember to put a space between a number and the units of measure. It is 400 m, not 400m.**

We have implemented this change throughout the manuscript.

**The remainder of my copy edits are on the manuscript file (attached).**

Comments from the manuscript file are included below, with our responses. We have incorporated all additional copy edits unless otherwise noted.

**Line 45: The term “hereafter” is used here but “hereinafter” for woodcock. Be consistent.**

Switched all instances to “hereinafter”.

**Line 50: Needs citation.**

The radar studies we are referring to here are Cohen et al. (2022) and White et al. (2020), which are described in more detail in the following sentence.

**Line 69: Not in Lit Cited.**

We have added this citation to the Literature Cited.

**Line 80: Need some background about their life history – where are they found and where / when do they migrate? To put this into geographical context.**

We have added the following text to the introduction:

*p. 4*

*American Woodcock (Scolopax minor) are an upland species of Scolopacid distributed throughout eastern North America. They are among the earliest avian migrants in spring (February–May) and the latest migrants in fall (October–December), likely timing their migration based on the availability of earthworms, which are their preferred prey (Fish et al. 2024, Berigan 2024, McAuley et al. 2020).*

**Line 83: Abbreviation US used here but United States used later.**

Changed to USA.

**Line 97: Here “and” is used but Brooks & Gelman use ampersand.**

We have changed all two-author references to use “and” instead of an ampersand.

**Line 107: Poor grammar to pair “from” with an en dash.**

Changed to “to”.

**Line 116: This is confusing and suggests that after capture, they would be considered adults.**

We have rewritten this sentence as follows:

*p. 5*

*We aged and sexed birds upon capture, where we classified birds undertaking their first fall and spring migrations as juveniles, and all other birds as adults.*

**Lines 120–121: This needs to be written in plain English. Are the authors trying to say that they determined whether a bird was migrating or not when they received the GPS location? This needs more explanation. I’m not following.**

We have rewritten this section to state the following:

*p. 6*

*We subset these locations to include only those within the migratory classification dataset produced by Berigan (2024). This dataset classified individual locations as migratory or non-migratory based on the assumption that migration starts after the first >16.1km movement and ends after the final >16.1km movement of the season.*

**Line 131: You have modified this to now be 1300-1500 I thought?**

As all locations collected at 1300–1500 hours Eastern Time are considered to be diurnal locations, we’ve elected to keep this phrasing.

**Line 131: As opposed to unknown ground locations? I don’t follow.**

We have revised this sentence as follows:

*pp. 6–7*

*We therefore made a modeling assumption that all diurnal locations could be treated as though they were known to be recorded on the ground (hereinafter “known ground locations”).*

**Line 133: Is this based on a date or an activity pattern?**

Added “*based on the classification in Berigan (2024)*”.

**Line 134: Unclear what this means. Is a step an incremental change in location that occurs in one continuous movement? Unclear what a “stopover movement” is and what the 6.68 km measure refers to.**

We have rewritten this section as follows:

*p. 7*

*As woodcock are nocturnal migrants, we define potential flight locations as all points that were nocturnal, occurred during migration based on the classification in Berigan (2024), and were preceded and followed by >6.68 km steps (defined as lines connecting consecutive locations). The 6.68 km threshold was based on the 99th percentile of step lengths recorded within a stopover site (Berigan 2024). Ensuring that the preceding and following steps were >6.68 km increased the likelihood that the bird had moved away from a stopover site before the point was recorded.*

**Lines 136–137: Delete “known”**

See our response to Line 131. “Known ground location” is an important term for explaining our modeling process and we would prefer to retain it.

**Line 182: Other references use “and”.**

We have changed all two-author references to use “and” instead of an ampersand.

**Line 189: This is a gratuitous abbreviation that serves no purpose since it is never used. Remove.**

Done.

**Line 200: The abbreviation US was used earlier.**

Changed to USA.

**Line 203: needs citation**

We have specified the citation for the 120-m threshold in the sentence above:

*p. 9*

*We compared woodcock flight altitudes to the minimum altitude (120 m) detected by Horton et al. (2016) using the Next Generation Weather Radar (NEXRAD) system, a weather radar system in the USA frequently used to study bird migration (DeMott et al. 2022, Horton et al. 2023).*

**Line 213: Unclear what’s happening with the other individuals. They had GPS positions but their locations were unknown? Is this related to nocturnal vs diurnal locations?**

We have rewritten this section as follows:

*p. 10*

*We collected 16,293 GPS locations with altitude recordings from 344 individuals. Most of these locations (9,658) were recorded at 1300–1500 Eastern Time and were classified as known ground locations. Of those locations remaining, 258 met the criteria to be possible migratory locations (106 individuals).*

**Line 214: CRI needs to be defined before it is used like this.**

We have added a definition for this acronym on page 9.

**Lines 216–217: Give sample sizes for fall and spring.**

Sample sizes are now included in Table 1.

**Line 248: The x-axis should be Mean altitude (m) to avoid putting m with each number on the x-axis label.**

Done.

**Line 253: X-axis label should be Flight altitude (m) to avoid having to put m beside each unit of measure on the x-axis.**

Done.

**Line 273: Not consistent**

We have changed all two-author references to use “and” instead of an ampersand.

**Line 290: citation**

Added a citation to McAuley et al. (2020).

**Line 298: I’m assuming this is all taxa and not just woodcocks.**

That’s correct; we’ve implemented your suggested text.

**Line 301: US has been used previously.**

Changed to USA.

**Line 305: US has been used previously.**

Changed to USA.

**Line 442: Incomplete**

We have added a URL to the citation for this report.