Tracking Fall Migration of American Robins Using the ICARUS Tracking System

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Purpose and Objectives

Purpose: Understand the migration behaviour of American Robins using the ICARUS tracking system.

Objectives:

1. **Describe the patterns and behaviours of the fall migration of the American Robin using precise daily GPS data collected from the ICARUS tags and determine whether these observations fit the predictions for this diurnal, slow-paced, medium-distance migrant (Vanderhoff et al., 2020).** Migratory patterns and behaviours examined include the timing of departure, migration rates, location and duration of stopovers, and timing of arrival at wintering sites (Chan, 2021).

2. **Investigate whether sharp decreases in temperature are connected to the timing of daily, southward flights.** Changes in environmental conditions influence daily migration decisions (Oliver et al, 2020). It is predicted that southward movements from stopover sites during fall migration are correlated with rapid drops in temperature (Fudickar et al. 2013).

Methods

- American robins were captured at Assiniboine Park through mist netting followed by the collection of their morphometric data. Robins weighing at least 85.0 g were mounted with the ICARUS tracking tag and released to track their migratory journey.
- Daily GPS data from the deployed ICARUS tags can be downloaded from the Movebank database.
- Microsoft Excel was used for data exploration and RStudio for further data analysis. RStudio packages including readxl, ggmap, ggplot2, sf, and geosphere are used to read in excel datasheets, plot migratory tracks of American Robins on a map, and calculate the distances flown by individual robin.
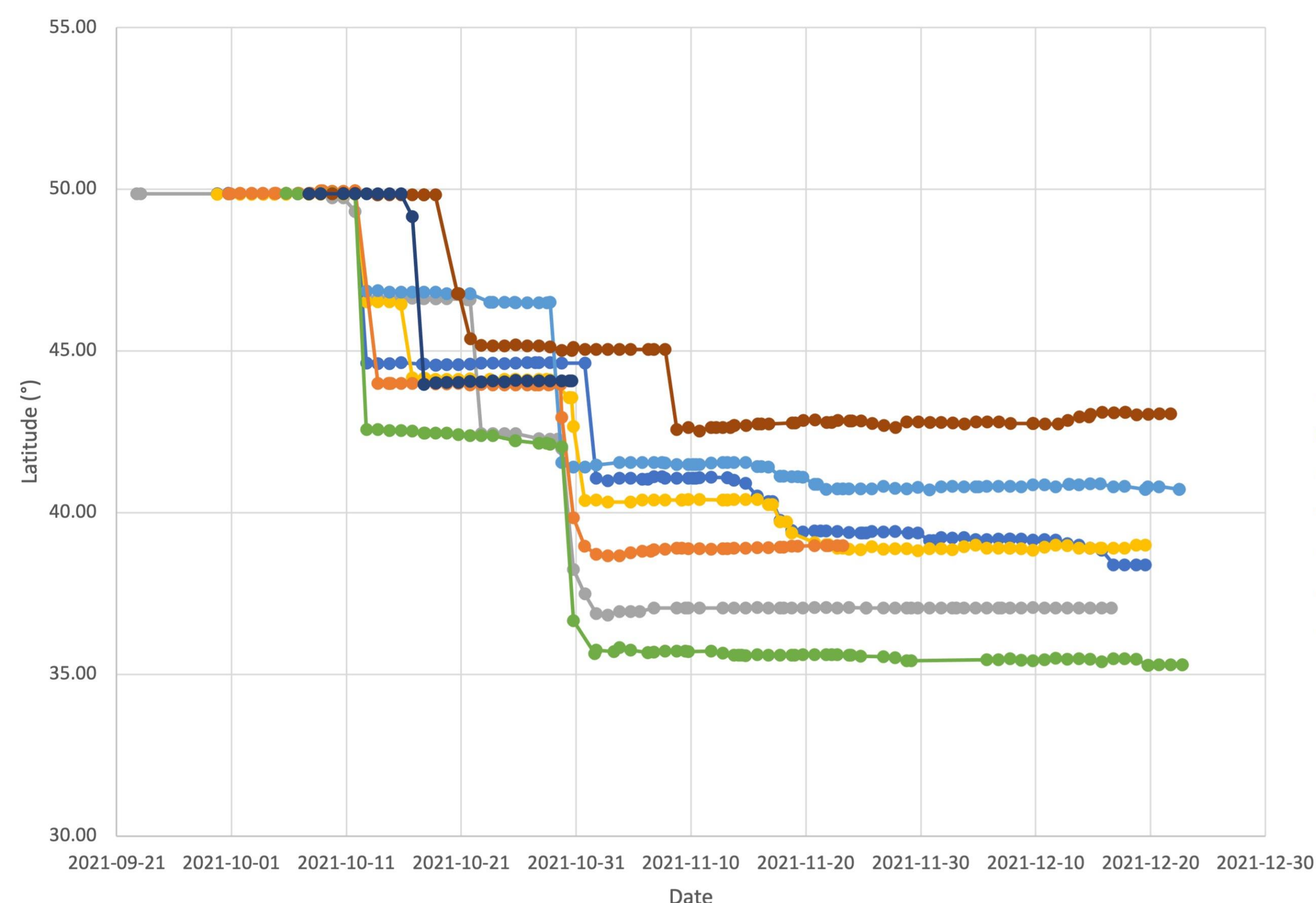
Preliminary Results and Discussion

Figure 1. Latitude-time graph of the fall migratory tracks of American Robins

Preliminary Results and Discussion

- The tagged American Robins made major southward travels within a day around October 12 and November 1 (Figure 1). Birds which migrated longer distances overall tended to make larger leaps in between. (Figure 1).
- Initial investigation shows that the local temperature dropped significantly at those timings. Sharp decreases in temperature may be correlated to these significant southward movements.
- There were records where European blackbirds *Turdus merula*, a close relative of American Robins, responded to a temperature drop and flew > 400 km in one night (Fudickar et al. 2013).
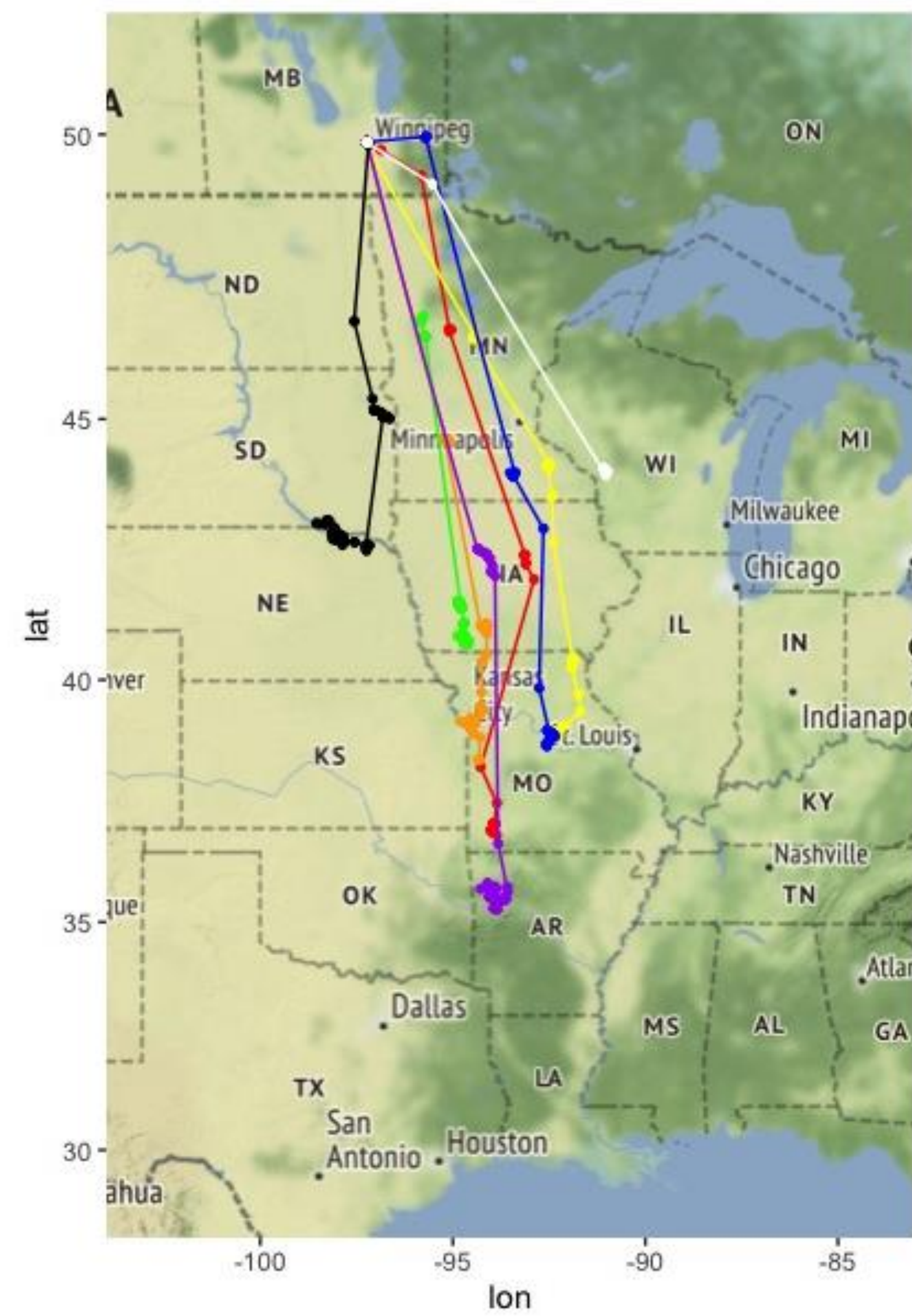

Figure 2. Fall migratory tracks of American Robins mounted with ICARUS tags.

- The tagged American Robins migrated an average total distance of 1601 km in 21 days. The average rate of migration is 77.39 km/day.
- The number of major stopovers are 1 – 2.
- A major stopover is defined as a small area where a migratory bird stays for a few days after a major southward movement. Visually, a cluster of data points is seen at a stopover site, indicating that the bird stayed in the area for a few days.
- The latitudes of the overwintering locations range from 35.74°N to 42.57 °N (black clusters in South Dakota and purple clusters in Arkansas in Figure 2).

Table 1. Summary of patterns of the fall migration of the American Robins.

ICARUS tag#	Total distance (km)	First day of migration	Date arrived at destination	Duration of migration (days)	Speed (km/day)	# major stopovers
13916B	1650	2021-10-11	2021-11-01	22	75.01	2
1A9319	1587	2021-10-12	2021-11-01	21	75.59	1
15EAD5	1581	2021-10-12	2021-10-31	20	79.03	2
0FE6EC	NA	NA	NA	NA	NA	NA
1FBB82	929	2021-10-12	2021-10-29	18	51.61	1
10A188	1511	2021-10-13	2021-11-01	20	75.54	1
10700E	2002	2021-10-12	2021-11-01	21	95.34	1
202A0E	1277	2021-10-20	2021-11-08	20	63.83	1
243784	854	2021-10-16	NA	NA	NA	NA

Challenges and Problems

- Background knowledge and cross-referencing with literature
  - Reliable sources e.g. Birds of the World
  - Papers published by the lab
- Defining a stopover and the date arrived at overwintering site
  - Continuous movements
  - Regional movements
  - Change in latitude, clusters on the map, steep slope on the graph etc.
  - Consult with advisor and literature
- Mapping migratory tracks and calculating distances on RStudio
  - Online resources
  - Sought help from other students in the lab
- Missing GPS data e.g. no data after a certain date, no data for a tagged bird

Next Steps

- Verify the calculated distances and migration rate by using alternate calculation methods and cross-referencing with literature.
- Simplify the R code used for calculations.
- Work on the Objective 2, exploring the correlation between temperature decrease and major southward movements of the American Robins.
- Revise the paper-in-progress based on the comments provided by the advisor.
- Continue writing the final thesis. Expand literature review section and organize the result section.

Figure 3. American Robin. Taken by Kyle Tansley, Cornell Lab of Ornithology.

References

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