Relationship between migratory distance and potential biomarkers of lifespan in a sunflower crop pest, the red-winged blackbird

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Introduction

- Red-winged blackbirds (*Agelaius phoeniceus*) migrate different distances from their breeding grounds in the Prairie Pothole Region to their overwintering locations.
- Traveling longer distances could be associated with higher mortality risks. In addition, high metabolism associated with migration can contribute to attrition of telomeres, DNA-protein complexes at the end of chromosomes, in long distant migrants.
- Migrants traveling shorter distances could benefit from earlier arrival to breeding grounds, increased offspring production and survival.
- **Thus, shorter distance migrants could potentially have a longer lifespan and more offspring that contribute to the damage to sunflower crops.**
- Telomeres can be damaged by reactive oxidative species (ROS) produced by aerobic metabolism. ROS can also damage other important molecules such as lipids. Lipid peroxidation is initiated by ROS producing an intermediate, Malondialdehyde (MDA). MDA is used as a measure of oxidative damage to lipids.
- The objectives of this study are (1) to test the hypothesis that telomere loss and oxidative damage are related to migratory distance between non-breeding and breeding grounds, and (2) to examine relationships among oxidative damage, migratory distance, and telomere loss.

Prediction 1: Telomere loss and oxidative damage in long-distance migrants > shorter-distance migrants.

*Prediction 2: O*xidative damage will be positively correlated with telomere loss and migratory distance.

Figure1: Red-winged blackbirds in a sunflower crop in North Dakota.

Methods

- Red-winged blackbirds captured in 2018 and recaptured in 2019 at Alice, North Dakota.

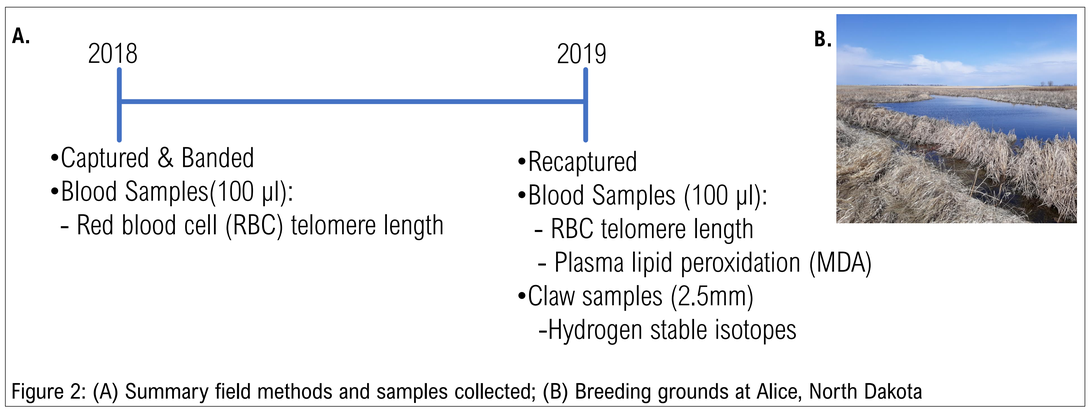

Figure 2: (A) Summary field methods and samples collected; (B) Breeding grounds at Alice, North Dakota

- Telomere loss = Δ 2019 - 2018 telomere lengths
- Migratory distance = overwinter latitude from claw stable isotopes ratio (δ^2H).
  - overwinter latitude is inferred from latitudinal gradient in δ^2H in precipitation [1]

Results

- Telomere loss tended to be greater in birds with longer migrations (r^2= 0.23, p = 0.13)
- Oxidative damage to lipids was not correlated with telomere loss (Spearman r = -0.21, p = 0.54) or migratory distance (Spearman r = -0.16, p = 0.64)

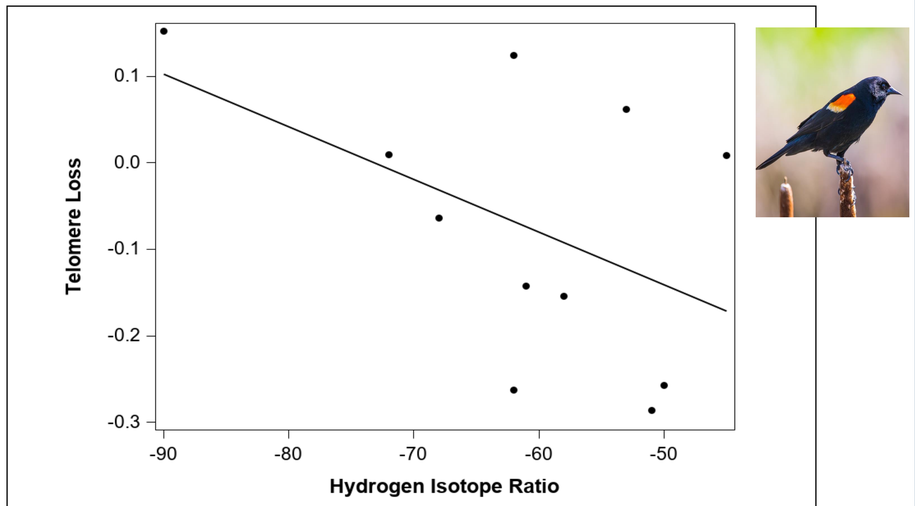

Figure 3: Hydrogen isotope ratios are used to infer overwinter latitude where a value of -90 represents a short distance and -50 represents a long distance to breeding grounds.

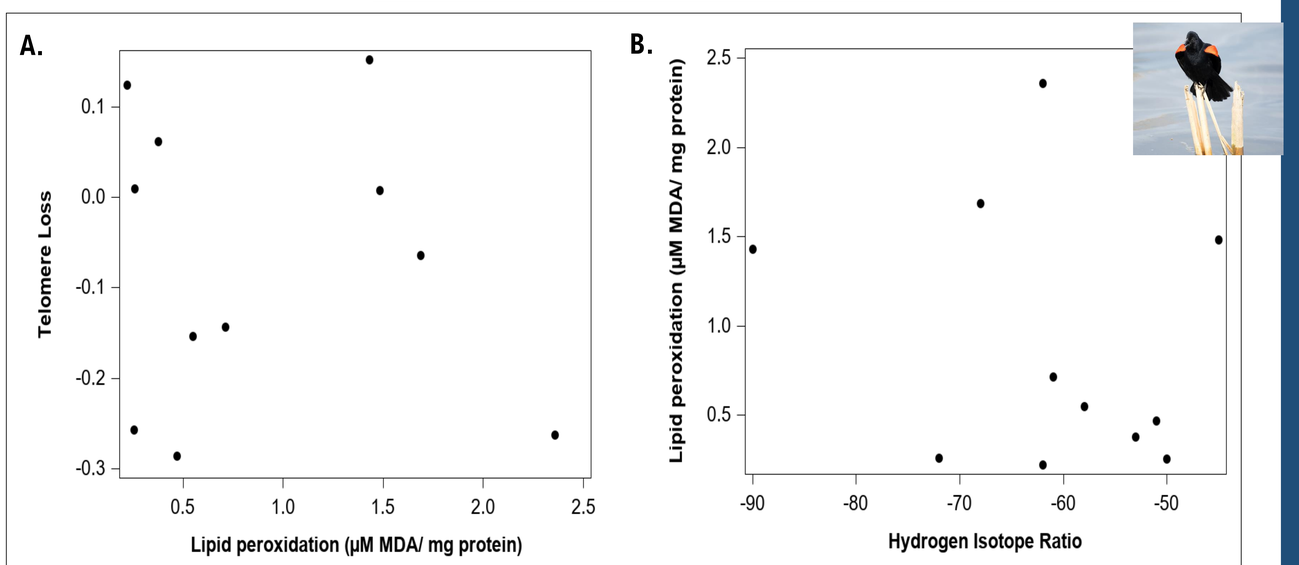

Figure 4. Hydrogen isotope ratios are used to infer overwinter latitude where a value of -90 represents a short distance and -50 represents a long migratory distance to breeding grounds.

Discussion

- Understanding physiological factors impacting lifespan in red-winged blackbirds could provide useful information to improve management strategies for this sunflower crop pest.
- Telomere loss could be influenced by physiological costs associated with the distance traveled during annual migration.
- Small sample size (n = 11) is likely influencing the preliminary results.
- The preliminary results will be analyzed with data collected 2020 and with future field seasons to evaluate if the trend observed achieves statistical significance.

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Literature cited:

[1] Woodworth, B.K., Newman, A.E.M., Turbek, S.P., Dossman, B.C., Hobson, K.A., Wassenaar, L.I., Mitchell, G.W., Wheelwright, N.T., & Norris, D.R. (2016). Differential migration and the link between winter latitude, timing of migration, and breeding in a songbird. Oecologia, 181,413 - 422.