

Ketterson / Nolan Research Group Collection

This document is part of a collection that serves two purposes. First it is a public archive for data and documents resulting from evolutionary, ecological, and behavioral research conducted by the Ketterson-Nolan research group. The focus of the research is an abundant North American songbird, the dark-eyed junco, *Junco hyemalis*, and the primary sources of support have been the National Science Foundation and Indiana University. The research was conducted in collaboration with numerous colleagues and students, and the objective of this site is to preserve not only the published products of the research, but also to document the organization and people that led to the published findings. Second it is a repository for the works of Val Nolan Jr., who studied songbirds in addition to the junco: in particular the prairie warbler, *Dendroica discolor*. This site was originally compiled and organized by Eric Snajdr, Nicole Gerlach, and Ellen Ketterson.

Context Statement

This document was generated as part of a long-term biological research project on a songbird, the dark-eyed junco, conducted by the Ketterson/Nolan research group at Indiana University. For more information, please see IUScholarWorks (<https://scholarworks.iu.edu/dspace/handle/2022/7911>).

License/Disclaimer Statement

By downloading this document or using any information contained therein, you agree to the license terms outlined at <https://scholarworks.iu.edu/dspace/handle/2022/15256>, which explain terms governing use, creation of derivative research, and requirements for citing the document.



The effect of climatic change on the breeding phenology of the dark-eyed junco, *Junco hyemalis*

Sara N. Friedline¹, Kimberly A. Rosvall², Nicole M. Gerlach², Ellen D. Ketterson²

1. Department of Environmental Science, 2. Department of Biology, Indiana University, Bloomington, IN, USA, 47405



INTRODUCTION

In response to overwhelming data in support of climate change,¹ ecologists have asked how a changing climate may affect the breeding behavior of organisms. A wide body of research supports the hypothesis that organisms time their breeding behavior with photoperiod, as well as weather, food availability, and the presence of predators or competitors.^{2,3} However, few studies have examined these changes in North American bird species.

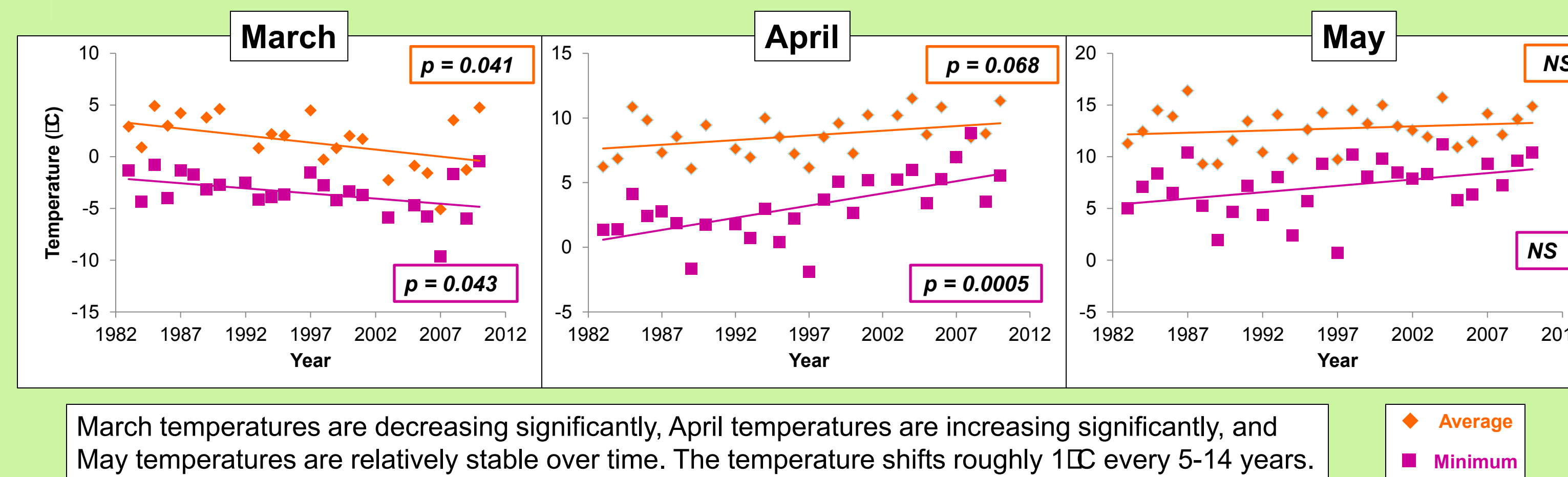
Members of our team have been studying a population of Dark-eyed juncos (*J. hyemalis*) breeding in the Appalachian mountains for 28 years.^{4,5} Using data from this long term dataset, we compared the date female juncos lay their first egg each spring (**egg one dates**) to changes in air temperature during the pre-breeding and the early breeding season. Specifically, we asked:

1. Is the climate changing, and if so, how?
2. Are juncos breeding earlier over time? Can changes in temperature explain shifts in breeding phenology?

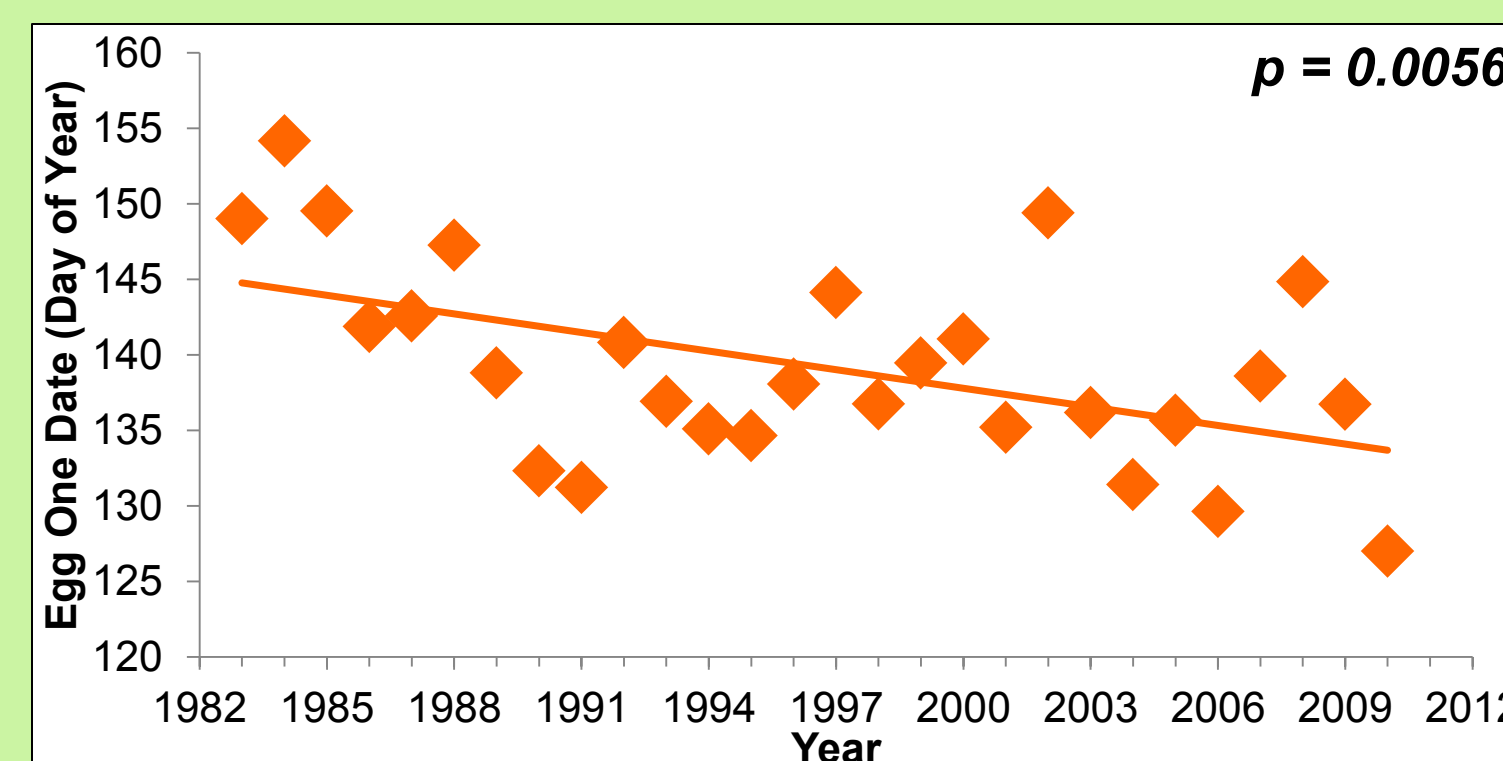
METHODS

- Obtained egg one dates from our long term dataset (1983 to 2010)
- Obtained minimum and average temperatures from the online NOAA database, focusing on March, April, and May.
- Only the first nest of the year for each female was used in the analysis.

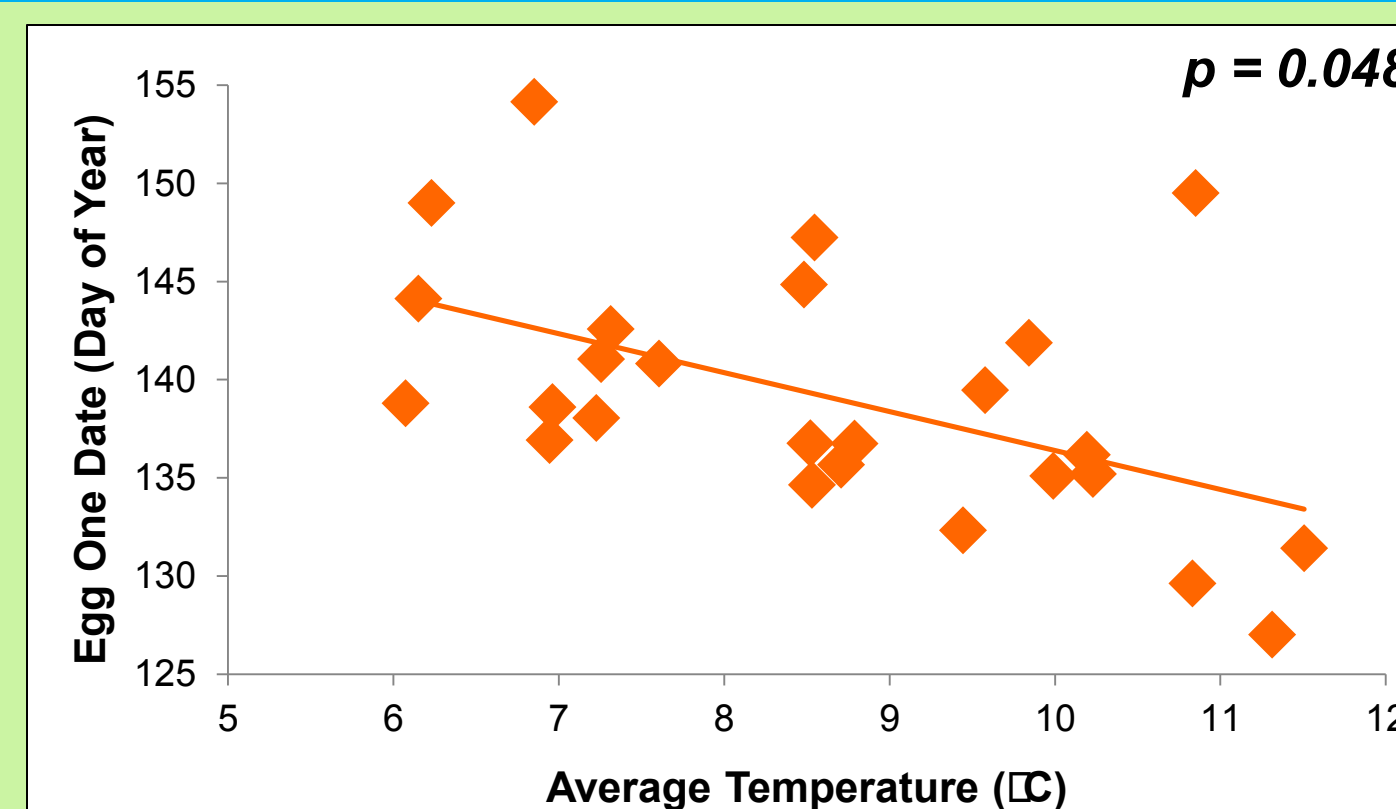
Dramatic changes in daily temperature in the last 30 yrs



Juncos are breeding significantly earlier in the spring



April temperatures strongly predict breeding date, *independently* of year.



Breeding dates advance roughly one day for every ½ degree change in April temperature.

CONCLUSIONS

- Juncos at Mountain Lake, VA are breeding earlier over time.
- Warmer April temperatures appear to be a contributing factor.
- Delayed breeding dates in colder-than-normal recent years suggest behavioral plasticity.

FUTURE DIRECTIONS

1. Is the climate becoming more volatile?
2. Do fall temperatures affect breeding phenology and population recruitment in the following spring?
3. How does climate change affect offspring or adult survival?
4. Is this an example of evolution or behavioral plasticity?

ACKNOWLEDGMENTS

We are thankful for the many members of the Junco crew who dedicated time and effort to nest searching at Mountain Lake. We are also grateful for funding from the National Science Foundation and the Indiana University Department of Environmental Science that made this research possible.

REFERENCES: (1) Walther et al., 2002. *Nature*. (2) Clotfelter et al., 2007. *Oecologia*. (3) Visser et al., 2004. *Adv. in Ecol. Research*. (4) Ketterson et al., 1991. *Hormones and Behav.* (5) Ketterson et al., 2009. *Int. and Comp. Biol.*