

## The Effect of Climate Change on Bird Ranges and Migration

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### Abstract

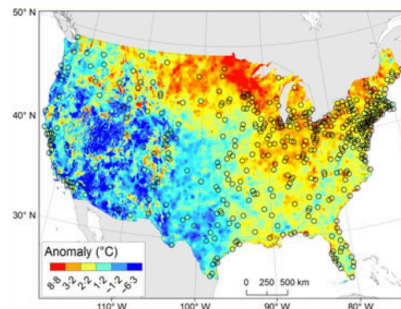
Migratory bird species are heavily impacted by the changing climate. Rising temperatures cause migrant birds to shift their ranges northward and arrive earlier to their destinations. This inevitably creates a mismatch between the arrival dates of birds and the resources available to them. To assess the relationship between rising temperatures and bird ranges and migration, a literature review was conducted focusing on the influence of the North Atlantic Oscillation on a bird's migration route. Reproductive success, finding mates, and other factors dependent on the arrival, timing, and destination of these bird migrants were analyzed. These findings hold implications on the impacts of global warming on species survival and biodiversity.

### Background

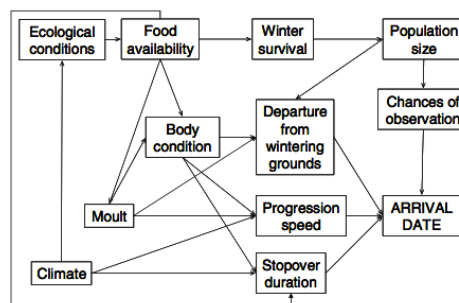
Global climate change is the leading cause of rising temperatures in different parts of the world. The extent to which these temperatures have risen is not uniform throughout the world, but the effects are quite apparent, especially when analyzing how avian species have responded to these changes [2]. Some of the changes that occurred in the lives of migrant species are early arrival dates to breeding grounds, longer time en route to migration, and a decline in the population due to them arriving in regions that have inadequate living conditions.

### Methodology

Obtain samples from bird data sets located in central Europe from 1980-2012.  
Use Christmas Bird Counts (CBC) to data on bird species found in Northeastern United States from 1980-2012.  
Calculate average temperatures from meteorological sites in the US and determine relationship between temperatures to migration patterns and shifting bird ranges.  
Calculate habitat suitability using vegetation index of regions of interest.



**Fig 1** The location of 476 Christmas Bird Count (CBC) circles and the anomaly between the 1975-79 and 2005-09 average minimum winter temperature (red = increase, blue = decrease) [1]



**Fig 2** Diagram depicting the potential variables that can influence arrival date phenology of a bird migratory population [2]

### Proposed Results

It is anticipated that there will be trends of early arrival dates due to warming temperatures. These warming temperatures will cause a timing mismatch for birds since they will be arriving in inadequate breeding grounds. Anthropogenic factors, such as urbanization and gas emissions, will change the environment of a species that will ultimately result in a change of behavior. This can lead to the northward shift of bird ranges as well as population declines.

### Discussion

Although the phenology of birds is shifting northward, a comparison must be done to the phenology of ecological conditions (i.e. flower blooming, caterpillar peak) to understand how mismatched the timing of migration is. Biological cues may override the impact of climate change, and this depends on whether the bird is a long-distant or short-distant migrant.

### Future Work

It is expected that research will continue to analyze trends between climate and bird ranges and migration. Studies incorporating gene flow analysis with spatial-analysis tools will aid in understanding the impact of habitat fragmentation to species population dynamics and change in behavior. Advanced models will be utilized to measure not only the phenology of birds but also the ecological conditions on various parts of the migration route.

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### References

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