

Effect of Changing Weather Patterns on Transatlantic Migratory Birds

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Background

As climate change takes hold of the globe, wind patterns are changing and extreme weather events are becoming more common. These phenomenon are having an effect on ecosystems around the world and more specifically for migratory birds in the northeast. Changing weather patterns over the Atlantic will affect the migratory routes for a number of birds that annually travel for thousands of miles across the ocean (La Sorte, et. al ,2016). Birds that cross the Atlantic ocean nearer to the Arctic are most likely to be affected by these changes, given this area is increasing in temperature faster than most any other part of the globe (Serreze, et. al, 2009).

Motivation

By being thrown off their normal migratory paths, vagrant individuals do not arrive in their intended destinations, oftentimes in ecosystems they are not adapted to or far distances from another individual of their species. With less mating within the species and lower birth rates, it is likely that we will observe a decline in the populations of a number of transatlantic migratory birds, many of which have previously declining populations due to other factors.

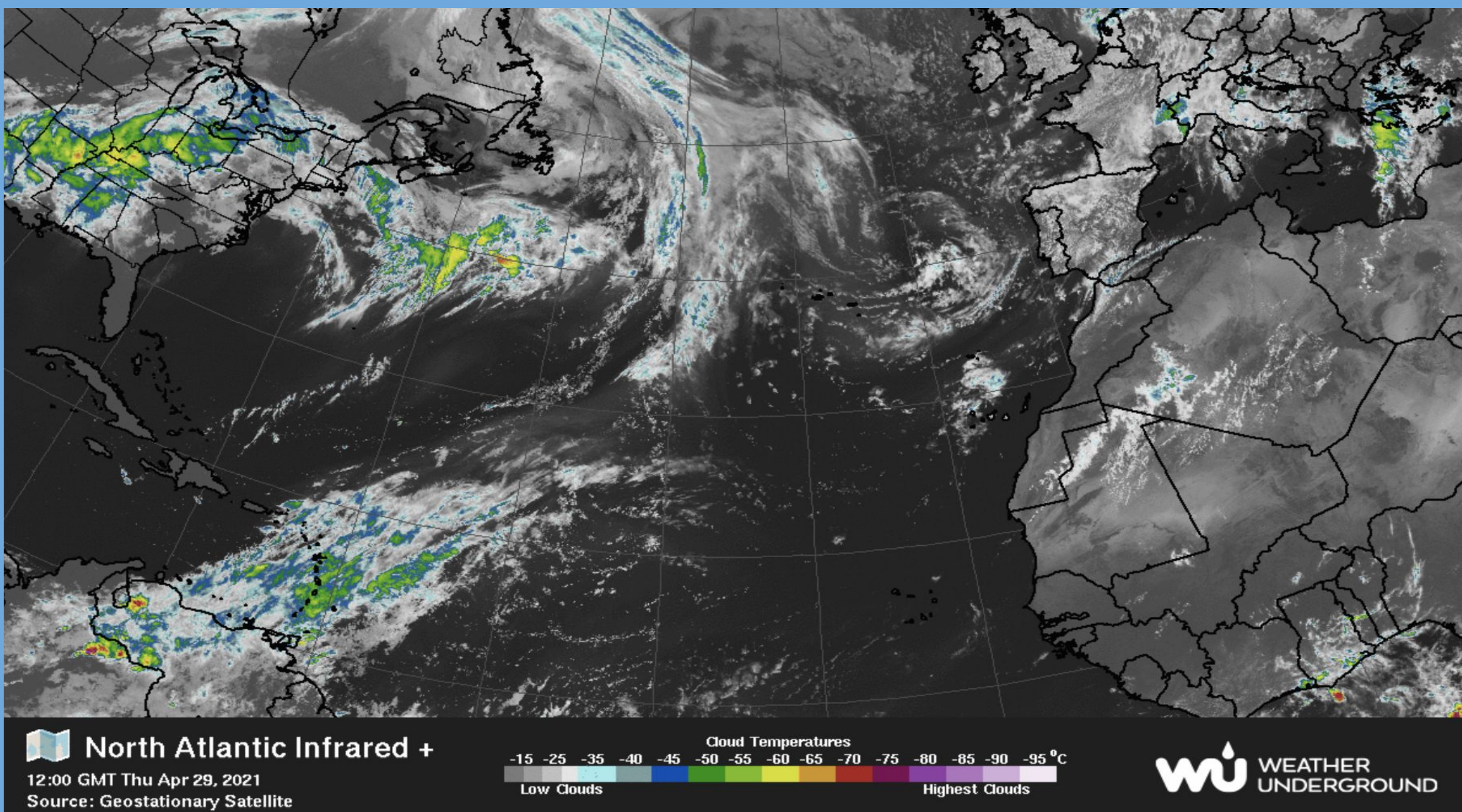


Figure 1. A storm system over the North Atlantic (North Atlantic | Global Infrared Satellite | Satellite Maps | Weather Underground, n.d.)

Objectives

Examine the vagrancy of three different transatlantic birds (pink-footed goose, tufted duck, northern wheatear) and determine how these species' patterns of vagrancy are affected by Atlantic weather patterns. If a relatively strong relationship can be established between time and number of vagrancy events, it might be possible to extrapolate into the future and make predicted values of vagrancy events which could be helpful to management plans.

By devising effective management strategies for these species that is based off of scientific studies could help to reduce the amount of vagrant birds in light of drastically changing and variable weather patterns. Additionally, creating management plans or conservation areas in the locations near where the vagrant individuals are appearing may help those vagrant individuals to find mates and help maintain the birth rate.

Hypothesis

Changes in prevailing winds alters the migration patterns of Pink-footed Goose, Tufted Duck, and Northern Wheatear.



Figure 2. Tufted Duck, Northern Wheatear, Pink-Footed Goose (left to right)

Prediction

Based on prior observations in Vermont and surrounding northeastern states, we predict that tufted ducks will likely have the largest number of vagrancy individuals in the coming years. Additionally, we believe that the number of vagrant individuals for northern wheatear and pink-footed geese will also increase in the coming years at a rate comparable to that of the tufted duck. Looking at similar studies from around the world shows that there likely is a correlation between climate change and vagrancy events. A study done on 46 different species in Siberia showed that 'there was a positive correlation between predicted increase in breeding range and vagrancy rates' which showed that climate change was rapidly changing the ranges for many bird species (Jiguet & Barbet-Massin, 2013). It is reasonable to assume that this sort of cause and effect relationship is similar in the northeastern United States.

Methods/Approach

Use public data from many sources, primarily, eBird, to track the vagrancy events in Pink-footed Goose, Tufted Duck, and Northern Wheatear. Each of these species are trans-Atlantic migrants, whos migration is greatly affected by weather over the Atlantic ocean. This makes them a good model for how climate change will affect migratory birds. We will then overlay our findings with weather data collected in the North Atlantic. This will be done over the course of 10 or more years, to observe the change in vagrancy as climate change progresses.

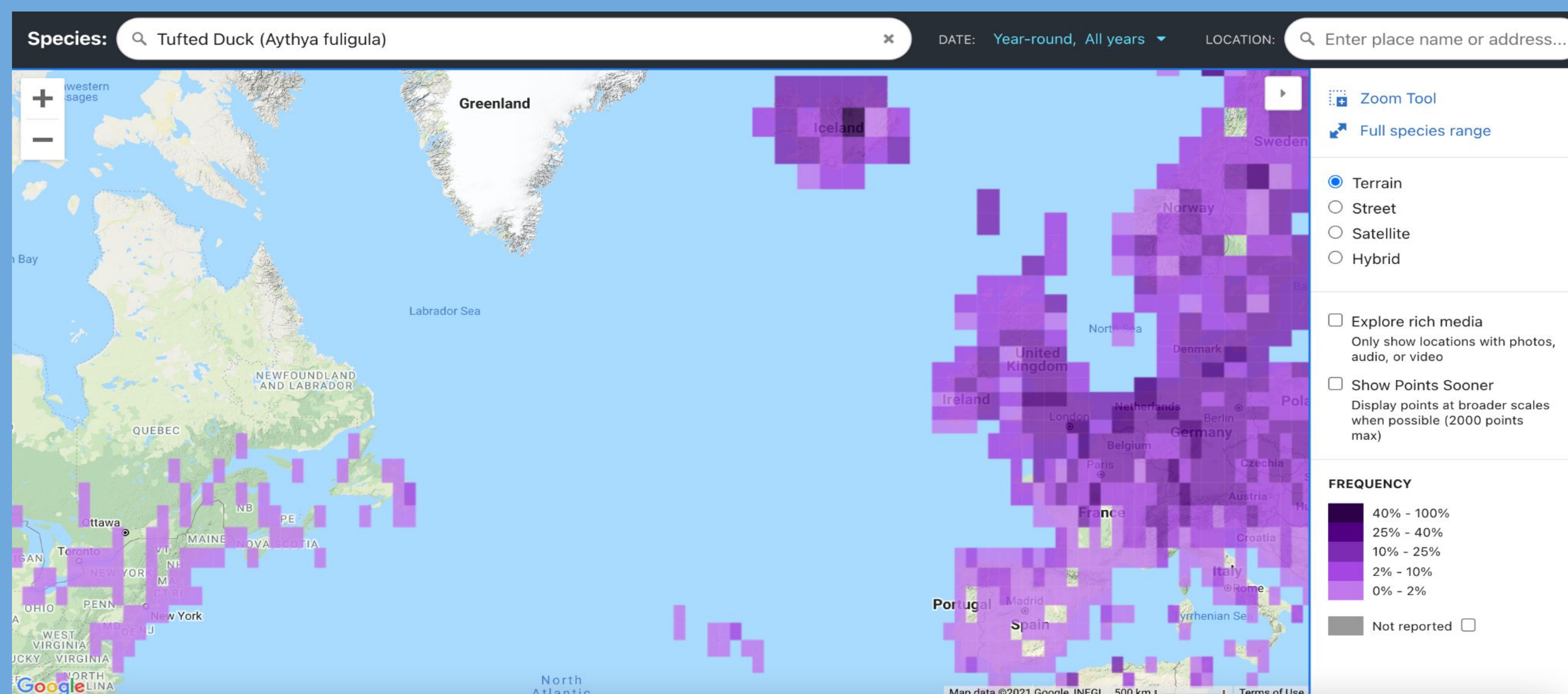


Figure 4. Tufted duck normal range, Europe, and vagrant sightings, North America.

Intended Analysis

Since this is an observational study with two continuous data types (vagrant individuals and average seasonal temperature of the North Atlantic) a regression analysis will be used. Because of the nature of an observational study, this will not be able to have a high level of inference or strength as there were no treatments imposed on the test subjects.

By using a regression analysis, a mathematical relationship between average seasonal temperature of the North Atlantic and number of vagrant individuals can be obtained. Using this equation, predictions can be made into the future which will be helpful for devising management strategies.

Number of Vagrants for Pink-footed Goose, Tufted Duck, and Northern Wheatear

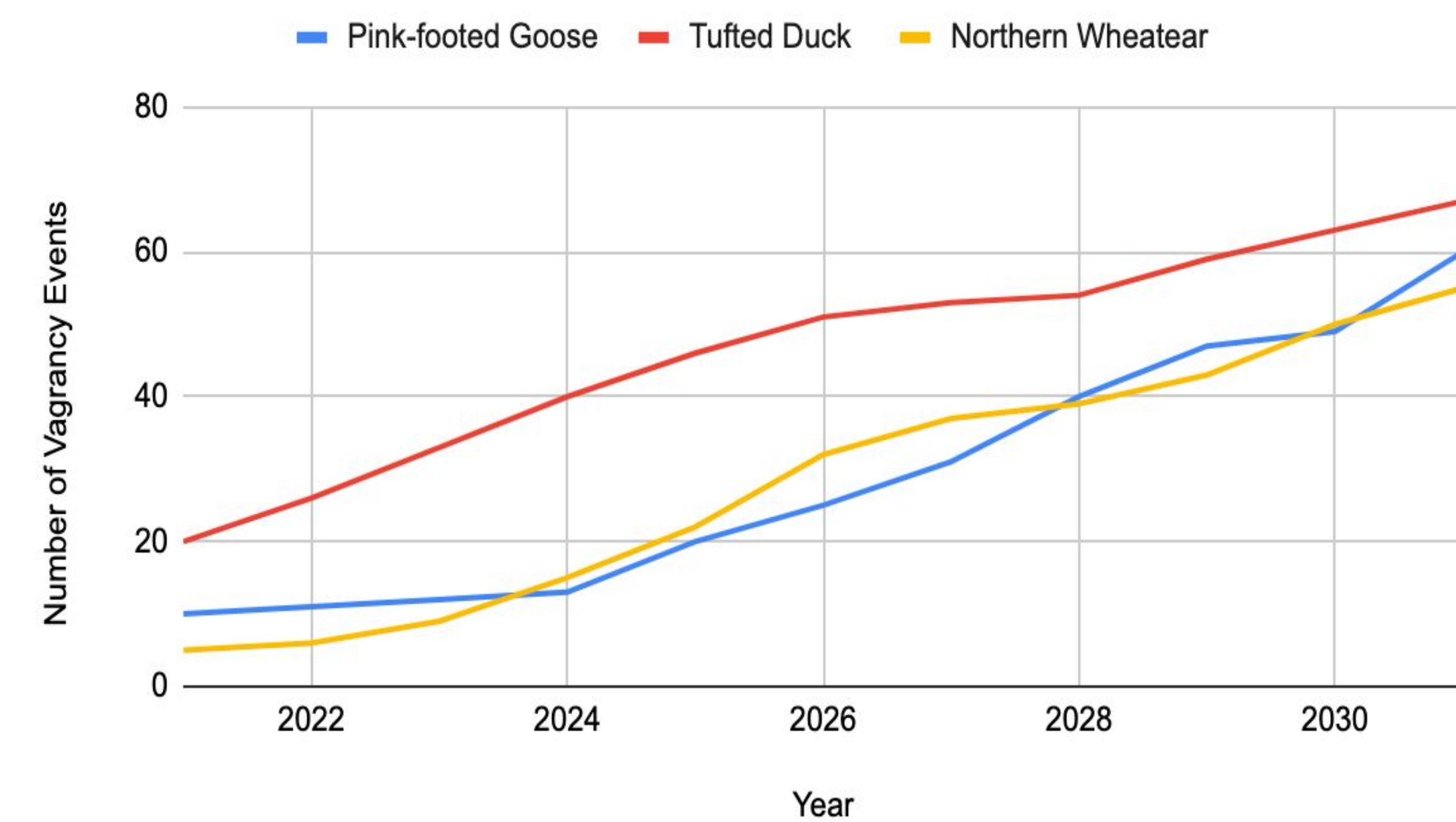


Figure 3. Number of reported vagrant individual in our three study species. This chart is prospective and assumes that climate change continues at the current rate. This graph uses time as a proxy for climate change (yearly average temperature increase) in the North Atlantic.

Implications

While these birds become more and more common in areas where they have not been found in the past, they will start to have effects on the environment they find themselves in. Additionally, they will likely have decreased birth rates until efforts are put into effect to help their populations. On the flip side of the story, these species will likely begin to adapt to these new locations and might even begin to thrive. If the vagrant populations become naturalized to certain areas, they will end up being competitors with the native species. For these reasons, the species in question for this study should be observed and specific management plans should be made.

Literature Cited

- Jiguet, F., & Barbet-Massin, M. (2012). Climate change and rates of vagrancy of Siberian bird species to Europe. *Ibis*, 155(1), 194–198
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