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Listening to climate change in my backyard: the frequency of overwintering Eurasian Blackcaps *Sylvia atricapilla* increased in a small town in Northern Italy, but not that of European Robins *Erithacus rubecula*

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Abstract

Climate change is reshaping biotic communities all over the world, and birds are often affected by climate variations, including outside the most investigated breeding season. Here, using an opportunistic but intensive data collection, I show how the frequency of overwintering Eurasian Blackcaps *Sylvia atricapilla* has increased in recent winters (since 2011-2012) in an area in northern Italy where it used to be very rare during the coldest months of the year. A linear model based on time progression explained more than half of the variation of the species' frequency. An alternative linear model based on the average daily temperature in the period December-February had a substantially similar (marginally better) performance, suggesting that such an increase could be driven by milder winter temperatures. A regular and abundant wintering species, the European Robin *Erithacus rubecula*, only showed fluctuations over the same period but not a temporal trend, nor a relation with average daily temperature. Given that the sampling effort was the same for the two species, finding a clear trend in Blackcaps but not in Robins pointed towards a real increase in the overwintering frequency of the former, rather than at sampling biases. This worked example also suggests that citizen science and opportunistically collected data could be potentially used to assess the effects of climate change on fine-scale, local variations in bird distribution, especially if collected in areas or contexts that are regularly visited by observers. Similar considerations may apply to passive/automated recorders.

Keywords: migration, passerines, Robin, temperature, winter

INTRODUCTION

Climate change is reshaping biotic communities all over the world, and birds are often affected by climate variations (Bateman et al. 2016, Scridel et al. 2017), and by the consequences of climate modifications, from changes in habitat characteristics (Matthews et al. 2011) to variations in biotic interactions (Brambilla et al. 2020). While many studies focused on breeding bird species and assemblages, avian species and communities are affected by climate change also during the non-breeding season. The wintering season is receiving increasing attention, because of marked changes in distribution and/or abundance of wintering species related to the ongoing climate change; well-known examples involved waterbirds (Lehikoinen et al. 2013, Pavón-Jordán et al. 2015), but similar dynamics might apply to passerines (Brambilla et al. 2024) and raptors (Morganti et al. 2017).

With this short contribution, I explore whether the frequency of a common species in Northern Italy, the Eurasian Blackcap *Sylvia atricapilla*, has increased in recent winters, in an area where it used to be very rare during the coldest months of the year. In the Prealps of northern Italy, where this study took place, Blackcap is a very common and abundant breeder, but typically a rare and localised wintering bird, mostly found during mild winters (e.g. Pedrini et al., 2005). Blackcap has been reported as a flexible species, able to adapt its migratory behaviour and strategies to changing climatic, available resources and environmental conditions (Berthold & Terrill 1988, Delmore et al. 2020, Plummer et al. 2015, Pulido & Berthold 2010, Van Doren et al. 2021). Therefore, it can be assumed that a possible increase in overwintering rate could be the result of climate change leading to more favourable, warmer winters; to test this, I also investigate the link between Blackcap frequency and average daily temperature during the winter. To exclude other possible confounding effects such as temporal increases in observation efforts, improved conditions for small wintering birds, increased food availability for insectivorous species, etc., I also evaluate the trend over the same period and in the same site of a species showing an opposite phenology and pattern of seasonal occurrence, the European Robin *Erithacus rubecula*. Indeed, the Robin is an abundant wintering species in the area, but a much rarer and localised breeder, especially in urban environments. Considering also Robins, surveyed with the same method and timing of the target species, allows testing for the occurrence of possible biases due to potentially different sampling efforts along the study period. This approach could be considered similar to the target-group background one, adopted to correct for sampling biases in species distribution models (Phillips et al. 2009).

STUDY AREA AND METHODS

The study took place in Cantù (Como province, Lombardy region; approximate position 45°44'N 9°07'E), in northern Italy, within the Prealps just north of the Po plain. The site at which all observations had been collected is located in the western part of the town, at an elevation of c. 360 m asl, and is characterised by residential buildings, frequently surrounded by small gardens and roads. I recorded all the observations of Blackcap and Robin I made at home (mostly vocal contacts), for 13 consecutive winters (1st December – end of February, from 2011-2012 to 2023-2024). No time was exclusively devoted to data collection; rather, I recorded all the contacts I obtained with the target species during standard behaviour at or around home. Given that most observations consisted of single individuals for Blackcap (377 obs. of 385 individuals), I considered the number of sightings rather than the number of individuals. For Robin (819 observations of 1058 individuals) also the overall number of individuals was analysed. The sampling effort was the same for both species, which were always recorded when heard or observed. The surveyed area was not explicitly defined, but considering the location of recorded individuals can be approximated to a radius of 150 m from home (i.e., 7 ha) for both species.

I downloaded from the ARPA (Agenzia Regionale per la Protezione dell'Ambiente) website (https://www.arpalombardia.it/temi-ambientali/meteo-e-clima/form-richiesta-dati/) the average daily temperature recorded at a meteorological station (Cantù Asnago) located very close to the study site. Temperature records included missing values for only three days during the period, and the latter were omitted from the computation. Winters were temporally ordered from 1 to 13, thus indicating time progression. The number of observations per each species per winter was modelled as a function of i) the winter progressive number as a continuous predictor, to test for a linear variation in the number of observations during the study period, and ii) the average daily winter temperature as a continuous predictor to test for a linear effect of temperature. For these analyses, a negative binomial one was selected to account for overdispersion in the number of observations of both species. Each model was subject to assumptions testing, using 500 simulated residual distributions. I evaluated the uniformity of residuals, the possible occurrence of outliers, the simulated vs. observed dispersion, the occurrence of zero-inflation and the distribution of residuals' quantiles. All tests led to non-significant outcomes and hence both models were considered as fully valid. Akaike's information criterion corrected for a small sample size was computed for alternative models (winter progression vs. average daily temperature) to evaluate which option (temporal increase or temperature effect) was more supported. The winter progressive number and the average daily temperature were strongly and significantly correlated (Pearson's r = 0.60, p=0.031), indicating a progressive increase in winter temperature (with an impressive change from a minimum of 1.33 °C in 2011-2012, to a maximum of 4.44 °C in 2023-2024), and thus their effects were separately modelled. Models' R2 was calculated using the 'r.squaredLR' command in MuMIn. Data were analysed in R, using the packages MuMIn (Barton 2020), and MASS (Ripley 2011) and model results and residual fits were graphically displayed with visreg (Breheny & Burchett 2018) and tested with performance (Lüdecke et al. 2020) and DHARMa (Hartig 2020) packages. Data are publicly available (Brambilla 2025).

Table 1. Number of observations recorded for the two target species during the study period between December and February

Winter	Blackcap *Sylvia atricapilla*	Robin *Erithacus rubecula*
2011-2012	4	52
2012-2013	1	85
2013-2014	8	46
2014-2015	5	86
2015-2016	6	46
2016-2017	4	52
2017-2018	3	33
2018-2019	3	84
2019-2020	7	62
2020-2021	19	115
2021-2022	11	66
2022-2023	23	41
2023-2024	14	51
overall	108	819

RESULTS

The number of observations of both species showed some fluctuations during the study period, but, while for the Robin no significant trend was detected, for Blackcap there was a clear increase (Table 1).

The numbers of observations of the two species were not correlated (r = 0.066, p = 0.829). The progressive number of winter and the average daily winter temperature had no effect on the negative binomial regression modelling the number of wintering or the overall number of individuals for Robin (all β values very close to zero; all P > 0.5, for three out of four models >0.9). However, both predictors had a strong influence on Blackcap observations (for the progressive number of winter: β ± SE: 0.15 ± 0.04, AICc 77.60, Fig. 1; for average daily winter temperature: β ± SE: 0.61 ± 0.16, AICc 77.26, Fig. 2). The two Blackcap models, therefore, were similarly supported, as indicated by the very small difference in their AICc values, and they also had a nearly identical and high R^2 (R^2 = 0.56 for the mode based on time progression; R^2 = 0.57 for the model based on temperature).

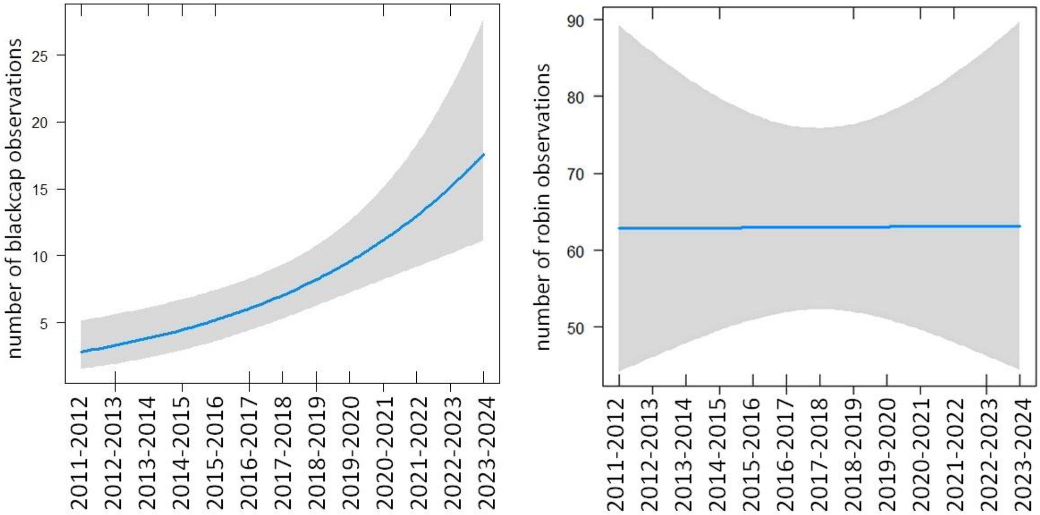

Figure 1. Modelled number of Blackcap and Robin observations per winter (December-February) during the period considered in the study.

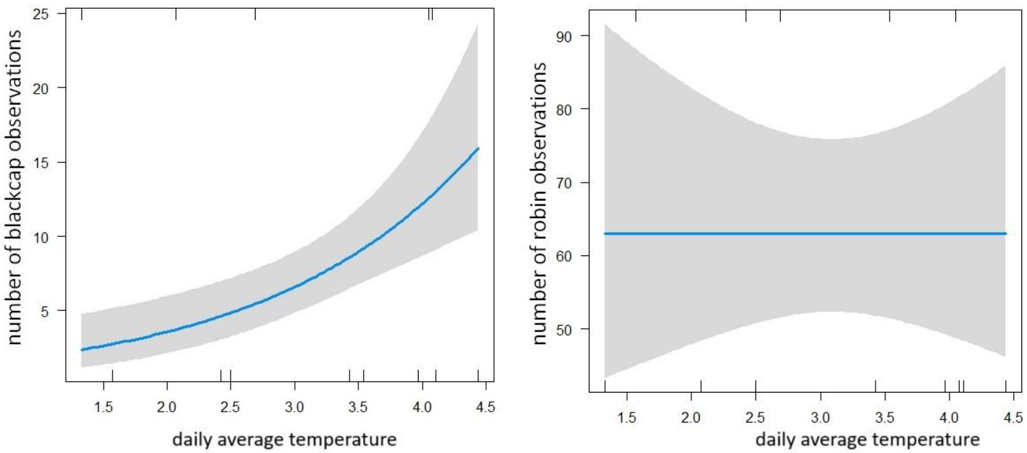

Figure 2. Modelled number of Blackcap and Robin observations per winter (December-February) in relation to average daily temperature recorded over the same period at a closely located meteorological station.

DISCUSSION

Climate change has pervasive effects on biodiversity and ecosystems worldwide. Birds are frequently used as model taxa to investigate its effects on species and communities (Pearce-Higgins et al. 2015). Even if most studies, especially in Italy, have been focussing on breeding period and distribution (e.g., Brambilla et al., 2022; Chamberlain et al., 2013; Scridel et al., 2017), climate change has already resulted in southern Europe in an increasing number of overwintering species and individuals belonging to taxa usually migrating over longer distances (Morganti & Pulido 2012), and in an increasing latitude of wintering assemblages of many species (La Sorte & Thompson III 2007). Wintering at higher latitudes, i.e. closer to breeding grounds, may provide advantages in terms of reduced energy consumption and risks along the migration routes, as well as earlier occupation of breeding areas with consequent better tracking of phenological advance due to climate change and reduced mismatch with spring phenology (Ambrosini et al. 2019, Koleček et al. 2020, Newton 2008).

Here, I provide a simple example of such dynamics on a common species, frequently found in urban areas, displaying flexible and complex migration strategies. Blackcaps are known to adapt their migratory behaviour as a response to climate change (Morganti & Pulido 2012, Pulido & Berthold 2010). The increase in the frequency of observations of overwintering Blackcaps within an area traditionally not occupied or seldom used by wintering individuals of the species highlighted such dynamics at a local scale. The marginally stronger effect of average daily winter temperature on the observation frequency confirmed that the increase in the species' occurrence rates can be due to climate change and, in particular, to milder winters.

The data used here to assess the changes in the frequency of winter observations of two model species had been collected through intensive but opportunistic efforts carried out at a single site. The paired surveys helped disentangle real trends from possible variations in the sampling efforts. Comparing the patterns shown by different species surveyed through the same methods might provide an easy-to-implement way to test for the reliability of temporal trends, similar to what is done to evaluate spatial patterns when dealing with species distribution (Phillips et al. 2009). This worked example, therefore, suggests that opportunistically collected data, citizen science data, or even data collected using passive automated recorders, could be potentially used to assess the effects of climate change on fine-scaled, local variations in bird distribution. Areas or contexts that are regularly visited (e.g., for job reasons, while commuting to the workplace, etc.) by observers might provide useful settings to collect data that over the years might provide useful information about phenological or distributional changes linked to climate and other environmental changes.

Conflict of interest

The author declares he has no conflict of interest.

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Data availability

All data used in this work are available on the UNIMI Dataverse repository at https://doi.org/10.13130/RD_UNIMI/EKJ3HG.

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