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Winter – Not Spring - Climate Drives Annual Adult Survival in Common Passerines: A Country-Wide, Multi-Species Modeling Exercise

Authors : Manon Ghislain, Timothée Bonnet, Olivier Gimenez, Olivier Dehorter, Pierre-Yves Henry

Abstract : Climatic fluctuations affect the demography of animal populations, generating changes in population size, phenology, distribution and community assemblages. However, very few studies have identified the underlying demographic processes. For short-lived species, like common passerine birds, are these changes generated by changes in adult survival or in fecundity and recruitment? This study tests for an effect of annual climatic conditions (spring and winter) on annual, local adult survival at very large spatial (a country, 252 sites), temporal (25 years) and biological (25 species) scales. The Constant Effort Site ringing has allowed the collection of capture - mark - recapture data for 100 000 adult individuals since 1989, over metropolitan France, thus documenting annual, local survival rates of the most common passerine birds. We specifically developed a set of multi-year, multi-species, multi-site Bayesian models describing variations in local survival and recapture probabilities. This method allows for a statistically powerful hierarchical assessment (global versus species-specific) of the effects of climate variables on survival. A major part of between-year variations in survival rate was common to all species (74% of between-year variance), whereas only 26% of temporal variation was species-specific. Although changing spring climate is commonly invoked as a cause of population size fluctuations, spring climatic anomalies (mean precipitation or temperature for March-August) do not impact adult survival: only 1% of between-year variation of species survival is explained by spring climatic anomalies. However, for sedentary birds, winter climatic anomalies (North Atlantic Oscillation) had a significant, quadratic effect on adult survival, birds surviving less during intermediate years than during more extreme years. For migratory birds, we do not detect an effect of winter climatic anomalies (Sahel Rainfall). We will analyze the life history traits (migration, habitat, thermal range) that could explain a different sensitivity of species to winter climate anomalies. Overall, we conclude that changes in population sizes for passerine birds are unlikely to be the consequences of climate-driven mortality (or emigration) in spring but could be induced by other demographic parameters, like fecundity.

Keywords : Bayesian approach, capture-recapture, climate anomaly, constant effort sites scheme, passerine, seasons, survival
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