

# Application of Bayesian integrated population models to national bird monitoring: a practical perspective

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**Abstract:** Many countries have instituted a national bird population monitoring scheme to track annual fluctuations in the abundances of widespread bird species over time. Understanding the environmental causes behind the fluctuations in a particular species, however, requires knowledge of variation in demographic rates: recruitment, survival and dispersal. These too may be monitored at large spatial scales, particularly through ringing and nest-recording schemes. Although each of these parameters may be analysed individually, much greater insight should come from analysing the data in combination, since each observed dataset may contain information on more than one parameter. We make use of recent developments in state-space (hidden-process) modelling to construct hierarchical population models for a number of species with a range of life-history and ecological strategies. We fit these models to combined census, productivity and survival datasets collected by volunteers participating in the BTO's national monitoring schemes, using MCMC estimation in JAGS. We introduce a scaling parameter into the models to account for unmeasured processes and assess to what extent this influences inference about population dynamics. We show that the models provide useful demographic insights and that by integrating the available datasets they enable one to explicitly assess the importance of unmeasured variables, which can be helpful in formulating conservation policies.