How much does the choice of process model matter when combining data from multiple surveys?

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Keywords: integrated population models, population dynamics

Abstract: We consider the consequences of including more or less biological detail in the process model component of an integrated population model. We consider three possible process models: a state-space time series model with vague biological detail, a purely biological model with vital rates estimated from a banding program, and a hybrid combination. We apply these models to annual data on Mourning Doves in the US Central Management Unit. Unknown parameters in the process models are estimated by combining four data sources: three surveys providing indices of population size and a harvest-based estimate of population size. Estimation was by two-stage MCMC using samples of secondary data. The choice of process model was evaluated by both DIC and the root-MSE-prediction of 2010 log population size from a model fit to 2003-2009 data. The hybrid approach was favored by both the DIC and root-MSE-prediction criteria. For these data, the state-space model tended to overestimate the log population size. The biological model and hybrid model tended to underestimate the log population size, probably because of poor estimates of some vital rates. The hybrid model is judged to predict better because estimates from it are less variable. Mourning dove management is based on the posterior distribution of trend estimates for the previous three years. The posterior distributions for the three process models are slightly different, but management conclusions are similar. The degree to which the choice of process matters depends on the analysis goal. If predicting future population size, the choice makes some difference; if predicting trend, the choice makes little difference, at least for these Mourning Dove data.