

# Population dynamical effects of spring migration phenology in passerine birds

Anderas Lindén<sup>a</sup> and Aleksi Lehikoinen<sup>b</sup>

<sup>a</sup> Aronia Coastal Zone Research Team  
Åbo Akademi University and Novia University of Applied Sciences  
Raseborgsvägen 9, FI-10600, Ekenäs, Finland  
andreas.linden@iki.fi

<sup>b</sup> The Helsinki Lab of Ornithology (HelLO)  
Finnish Museum of Natural History  
P.O. Box 17, FI-00014 University of Helsinki, Finland

**Keywords:** population dynamics, movement ecology, citizen sciences

**Abstract:** Migratory birds vary in their ability to adjust their timing of spring migration to earliness of spring. Negative correlations between spring arrival and population trends have been reported in earlier studies. A proposed explanation for this pattern is a temporal mismatch between food availability and requirement, which is thought to be of special concern in long distance migratory birds. To unravel possible drivers of population dynamics, we here study annual breeding population growth of 15 short distance and 12 long distance migratory passerines in southern Finland based on population indices estimated from standardized national monitoring data. Each species' phenological distribution of spring arrival is estimated using a non-linear negative binomial regression. The model fit is further used to obtain annual phenological covariates, which are applied in a density dependent population model with lags of zero and one. We hypothesize that phenological effects operating through reproduction (e.g., trophic mismatch) should be found with a one year lag, while variation in migration behaviour (e.g., climate induced prolonged migration) can cause correlation between phenology and local population densities without a lag. Results from naïve process error models and state-space models with predefined observation errors are analysed in parallel. In general, we found relatively little evidence for links between phenology and population growth. In contrast to what would be expected from earlier studies, most effects found were immediate, suggesting correlations between timing of migration and settling behaviour during migration, rather than effects on reproduction. We propose that boreal migratory birds might be better buffered against variation in spring earliness than previously thought.