86

Mechanistic hierarchical modeling reveals individual and demographic heterogeneity in migration strategy in a long-lived soaring bird

Migratory strategy, including timing, routes, as well as responses to conditions en route, influences individual fitness and reproductive success. Thus, migration can carry over to affect population dynamics, especially if demographic groups display different migratory strategies and behavioral plasticity. While the relationships between migratory behavior and weather have received considerable attention in the literature, approaches for understanding these phenomena mechanistically have largely been limited to the individual level. We used a hierarchical model with a mechanistic process component at the individual, single-season level to study seasonal migration in an Alaskan breeding population of golden eagles (Aquila chrysaetos). Our model allowed for joint inference about individual behavior, responses to weather, and underlying population-level processes driving individual behavior. Additionally, we used our model to disentangle the effects of year-to-year plasticity within individuals, heterogeneity across individuals, and local environmental conditions on population-level migratory patterns. We estimated parameters in our model using recursive Bayesian computing techniques to make it computationally feasible to fit the large hierarchical model to 30 individuals—each with up to 7 years of migration tracks—simultaneously. We characterized differences in migratory behavior and flexibility in responses to weather between territorial and non-territorial eagles, which is critical for understanding how changes in migratory strategies in response to changing environmental conditions may influence population dynamics for long-lived migratory species.