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Title. Latent Markov Models in Ecology

Abstract. Latent (or hidden) Markov models are powerful tools for analysing time series or other sequential data that depend on underlying but unobserved states. Due to their flexible hierarchical framework, which separates the noisy observation process from the latent Markovian state process, they have gained prominence across numerous empirical disciplines. In ecology, in particular, they have become immensely popular, as ecological data collected over time are often characterised by indirect and incomplete observations linked to latent states – such as animal behaviours that cannot be directly measured. For instance, in movement ecology, observed step lengths and turning angles are driven by an animal's hidden behavioural modes, such as resting, foraging, and travelling. As such underlying behaviours are of particular interest in animal ecology, I will focus on latent Markov models with discrete (rather than continuous) state spaces in my talk, specifically (discrete- and continuous-time) hidden Markov models and Markov-modulated Poisson processes. In particular, I will present three ecological applications: modelling diel activity patterns of fruit flies, surfacing times of minke whales, and capture-recapture data on bottlenose dolphin movement along the Scottish east coast. While the corresponding model formulations differ – particularly in their treatment of time – they share the same general structure, allowing for the same inferential methods to be applied and providing a unified framework for latent Markov models.