USE OF MONTE-CARLO PARTICLE FILTERS TO FIT AND COMPARE MODELS FOR THE DYNAMICS OF WILD ANIMAL POPULATIONS

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State-space models are a convenient and flexible framework for specifying stochastic models for the dynamics of wild animal populations and also the relationship between the populations and the data available about those populations. We illustrate this using a spatially explicit model for the population of British grey seals, for which the available data include a time series of estimates of numbers of pups born in each colony.

We describe how such models can be fit using Monte-Carlo particle filtering (also called sequential importance sampling). We also show how particle filtering can be applied to a model selection problem, where the goal is to determine whether culls of seals around salmon farms could be causing the recent levelling-off in seal counts in some areas.

We discuss the strengths and weaknesses of particle filtering for this application, relative to other fitting methods including the Kalman filter and Markov chain Monte Carlo.