Likelihood analysis of spatial capture-recapture models

Abstract

In this chapter we show how to compute maximum likelihood parameter estimates of SCR models both directly in R and through the R package secr (Efford, 2011). We walk through a simulation example when the number of animals, N, is known, and show that this approach is readily extended to the more general case where N is unknown. Using a discrete state space gives us the flexibility to clip out areas of non-habitat (for example, bodies of water) and carry out our likelihood analysis only across habitat deemed ‘suitable’. Likelihood functions for all these scenarios are provided in the accompanying R package and we apply these models to a wolverine camera trapping data set.

Alternatively, we can use the R package secr, which provides a range of functionalities to prepare data, run different models (e.g. with behavioral, time of site-specific effects) and summarize and visualize results. We guide the reader through all steps associated with an analysis in secr and re-analyze the wolverine data set, showing that results are essentially identical to what we observed using our custom likelihood functions.

While the Bayesian implementation of SCR models in the BUGS language gives us the flexibility to fit models we cannot readily fit in secr, for certain models a likelihood-based analysis is straightforward and more efficient.

Key words: Akaike Information Criterion, DENSITY, effective sample area, habitat mask, integrated likelihood, secr, unconditional likelihood