Consistency of Bayesian and maximum likelihood inference in state-space models of ecological systems with strongly nonlinear dynamics

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Abstract: Estimating population dynamics from data recorded with observation uncertainty is an important problem in ecology. Perretti et al. (2013) noted that standard Bayesian state–space solutions to this problem provide biased parameter estimates when the underlying population dynamics are chaotic. Consequently, forecasts based on these estimates show poor predictive accuracy, which lead Perretti et al. to conclude that "model-free" time-series methods are superior even to the correct mechanistic model when the latter is estimated in a Bayesian state-space framework. In Hartig & Dormann (2013), however, we showed that a simple modification to the standard state-space approach also suffices to remove the bias and reverse the previous results.

In this presentation, we will discuss in more detail when and why Bayesian and maximum-likelihood estimates fail when used for inference in nonlinear and chaotic dynamical systems. We will also discuss how to test for these conditions in real data, and what alternatives to the standard approaches for inference of state-space models are available that are robust under these conditions.

References

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