Comparing Information Criteria for Capture-Recapture Model Selection via Monte Carlo Simulation

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When analysing capture-recapture data, a core question is to choose the best fitting model for making inferences from the data.
Apart from hypotheses tests one generally uses optimisation of selecting criteria as a means of model selection procedure. These criteria can cover (a) mean squared error, (b) estimates based on Kullback-Leibler information e.g. AIC and TIC (assuming that the true model can only be approximated) and (c) consistent estimators of the dimensions of the model (assuming that the true model exists and is one of the competing models). I would neglect (a) and focus on the clarification of the latter two when doing Monte Carlo simulation to compare the applicability of them in favour of (b) in case of biological and social science applications. More precisely, usual simple structure of Monte Carlo studies generally result in preference of (c)-type criteria, because one knows the generating model. A more realistic Monte Carlo simulation would be shown to demonstrate the usefulness of (b)-type criteria in biological and social sciences.