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Score tests: better than sliced bread

Score tests are a convenient method for selecting between two nested models. They are often seen as more convenient than alternatives such as Wald tests and likelihood ratio tests as they only require a fit to be obtained for the simpler of the two models being considered. The more complicated model requires a computation of the likelihood and its derivative, but no optimisation is required. Therefore, score tests are a particularly attractive option for modern capture-recapture models, which can be highly time-consuming and challenging to fit. For example, some spatial capture-recapture models require several minutes for just one likelihood evaluation. The score test framework enables the researcher to select just one such model for eventual fitting. This framework has been extensively described in McCrea and Morgan (2011) and Catchpole and Morgan (1996).

Traditionally, the challenge of computing the derivative of the likelihood for complex models has meant that score tests have been underutilised. The development of TMB (Template Model Builder) means that automatic differentiation can be harnessed to greatly reduce the challenge of such computation, enhancing the accessibility of score tests. The speed and accuracy with which models can be fitted using TMB means that it also increases the scope and stability of score tests, as it becomes possible to use the estimated expected information matrix to calculate score test statistics. Negative score statistics no longer present barriers to implementing score tests. We will explore the utility of TMB as a vehicle for model selection testing within the score test framework.