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Model selection for integrated population models: selecting age structure with multiple data types

Integrated population modelling (IPM) unites different methodologies, such as capture-recapture and time-series models and has the advantage of providing a simultaneous description of all the data, increased precision of parameter estimates and the potential of coherent estimation of parameters otherwise not estimable from individual component analyses alone. An IPM will typically include a state-space model (SSM) component and the SSM structure is determined by a combination of biological considerations, what is observed and a study of the component demographic likelihoods in isolation. However it is natural to consider whether it would be advantageous to determine model structure using a combined likelihood.

Selecting age structure in survival using IPMs involves comparing SSMs with different dimensions. Using information criteria approaches is generally inappropriate and I recommend using likelihood ratio tests, highlighting when models of different dimension can be compared using standard chi-square tests. A complex senescence case study of Alpine ibex, Capra ibex, illustrates how the new approach can be used in practice.