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# Impact of Natural mortality assumptions on the assessment model performance

Natural mortality is one of the critical processes to provide scientific advice for fisheries management based on stock assessment models. However natural mortality cannot be measured and must be estimated inside or outside the assessment model.

Several methods exist to estimate M based on empirical equations or ecological theory and each one of them could give different results that can influence the assessment outputs. Here, we investigate the performance of several methods to estimate M using simulated data through the Rfishpop package implemented in R Core Team (2019) which includes tools to simulate the real dynamics of a fishery system using a generic age-structured operating model (OM) and also statistical methods for sampling data for the simulated population. Firstly, different settings are simulated using the OM, considering different fish dynamics and M structures. Afterwards, the data needed to estimate M (e.g. age max, growth parameters, weight or length at-age) are obtained from the sample functions assuming different sampling schemes. For each scenario a Montecarlo procedure is used to compute confidence intervals for the estimates of the natural mortality, then, such estimates are compared to real values of our simulated population through error measures as, mean square error (MSE) and the mean absolute percentage error (MAPE), which are used to compare and rank the models according to its performance. Once the set of models for estimating the M are evaluated, the next step is to study the behaviour of the assessment models depending on the estimated M.

Age structured models such as a4a are applied in each of the settings simulated before introducing as inputs the data derived from the sampling functions and the estimates of M derived from the corresponding models. As, in the previous step, for each scenario, a Montecarlo procedure is used to compute confidence intervals of the model outputs, and then such outputs are compared to the real population. The impact on the model diagnostics (e.g. retrospective pattern) and assessment results (e.g. stock status and reference points) will be evaluated to better understand the role of natural mortality uncertainty on scientific advice for sustainable fisheries management.