Alternative Ways to Evaluate Uncertainty and Risk in Data-Poor and Hypothesis-Rich Situations

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Delay-difference models such as stock reduction analyses (Kimura et al. 1997) have played a major role in providing a biological basis for management in North Pacific groundfish fisheries, particularly when detailed age-structured data are lacking. These methods typically require relatively large numbers of assumptions that may result in underestimates of stock assessment uncertainty. We propose introducing some Bayesian methods as a means to better reflect assessment uncertainty. For example, we allow for uncertainty in the historical catch estimates and other key population parameters typically assumed as fixed or measured without error. Also, we show the effect of adding a stochastic component to the recruitment function. A general method for determining MSY quantities in a complex assessment model is presented. Marginal distributions are given using posterior integration methods and through simple approximations based on normal propagation of error (Delta) methods. We demonstrate the use of these methods on simulated data and in real applications to rockfish species in the Gulf of Alaska.