

Modeling the stochastic dynamics of the aggregate stock in collapsed fisheries: the case of the northern cod

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Abstract

Motivated by the evidence that many collapsed stocks have failed to recover despite fishing mortality has been reduced, or even when a moratorium is currently in effect, we develop a spline methodological approach to analyze the stochastic population dynamics of fish stocks at low stock levels. The aim of this paper is to provide a simple mathematical model which allows us to analyze stochastic population dynamics of fish stocks at low stock levels. Unlike the conventional models, the concordance between the population dynamics of decline and recovery is not assumed, with a clear focus on modeling the stochastic aggregated stock (biomass) dynamics of collapsed species. The model can be used to analyze the consequences of all possible population dynamics at low population sizes, which can be different to those estimated at high stock levels, on the risk of collapse and non-recovery, in a setting of high degree of uncertainty. Considering the northern cod stock by way of illustration, we find that the lack of recovery of the species, despite the moratorium which still remains in force, is consistent with the hypothesis of weak compensatory population dynamics at low population sizes instead of the strong compensation estimated by conventional statistical methods