

A theoretic decision analysis framework to help managing Atlantic salmon fisheries

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Atlantic salmon (*Salmo salar*) populations are considered as locally endangered in many river systems. For providing management advice, there is a need for integrating the available ecological knowledge into models which help to evaluate the consequences of alternative management options. Models allow to quantify uncertainties associated with dynamics and management decisions. The management of natural populations typically aims at achieving the best compromise between some ecological and socio-economical issues. Models can help in solving such challenging multi-criteria objectives.

The decision analysis theory provides an optimisation approach to harvest regulation. It was applied to compare the performance of alternative regulation rules of the A. salmon rod-and-line fishery in the Sée-Sélune watershed (north-west of France). The framework works by the coupling of two operating models. The first one consists in a stochastic age-structured population dynamic model. The second model mimics the rod-and-line fishery in the watershed. Both models rely on data from the survey of the population and the fishery over 20 years. Fourteen fishery regulation rules were compared, including fixed harvest rate, fixed quotas and fixed escapement strategies. The consequences of each strategy in terms of conservation and exploitation were investigated via Monte Carlo simulations. Two non-linear utility functions were built to encode the simulation outputs, i.e. the escapement and the captures, in term of utility. These two utilities were then combined into a single criterion, which served as a basis to rank the strategies.

It was found that the best utility is achieved through the fixed escapement strategy. However, this strategy may be difficult to put into practice. Fixed harvest rate strategies revealed a good compromise between performance and easiness of implementation. The sensitivity of these results to some key hypotheses about both the population and the fishery dynamics are discussed.