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A Bayesian approach to model Atlantic salmon lifecycle in the Foyle catchment (Northern Ireland)

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Abstract

In stage-structured species it is rare to have datasets describing all the key stages for an extensive period of time. In addition, these datasets can be more or less reliable depending on the conditions in which they were collected thus leading to additional uncertainty. Uncertainty is taken in account within a Bayesian model as this approach provides a consistent framework to make direct probabilistic statements about unknowns as models parameters, missing data, unobservable variables and incorporating naturally uncertainty.
Atlantic salmon commercial fisheries in the Foyle catchment (Northern Ireland) have been declining during the last few decades. In order to provide an assessment of the actual stock size, we present a stage structured model describing Atlantic salmon lifecycle in the Foyle catchment Rivers during thirty seven years (1969 to 2005). The model includes density dependence regulation and has a probabilistic structure which allows environmental stochasticity. Data includes fishery catches, counter information, spawner and juvenile index for which uncertainty is incorporated according to the degree of belief in the data. A full Bayesian treatment of the model is carried out by means of Gibbs sampling. Outputs of main interest consist of the joint posterior distribution of all the model parameters and state variables such as the adult and spawner runs.