A Bayesian life cycle model to unravel changes in the marine productivity of Atlantic salmon population in the North Atlantic Ocean

Maxime Olmos, Félix Massiot-Granier, Etienne Prévost, Marie Nevoux, Gerald Chaput, Etienne Rivot

ICES CM 2016/D
Ecosystem changes and impacts on diadromous and marine species productivity

A Bayesian life cycle model to unravel changes in the marine productivity of Atlantic salmon population in the North Atlantic Ocean

M. Olmos, F. Massiot-Granier, E. Prévost, M. Nevoux, G. Chaput, E. Rivot

Abstract

Integrated life cycle models are key tools for an ecosystem approach to fish population dynamics and stock assessment. They allow analysing ecological processes underlying the spatio-temporal variability of different life stages, together with the integration of multiple interacting sources of environmental and anthropogenic stressors in a hierarchy of spatial and temporal scales along the life cycle. We developed a life cycle model for Atlantic salmon (*Salmo salar*) that captures the population dynamics of all stock units from the European (7 stock units from France to Iceland) and the North American coast (6 stock units from USA to Labrador) of the Atlantic Ocean. The model is developed in the Bayesian Hierarchical Modelling framework and assimilates a 44-years time series of data (1971-2014) compiled by the International Council for the Exploration of the Sea (ICES). Its hierarchical structure allows to separate out signals at different temporal and spatial scales in demographic traits, and enhance the ability to identify responses to key influential stressors. Results show that both survival during the marine migration and age at maturity exhibit common trends across stock units. These trends account for more than 50% of the total variance. These results support the hypothesis of a synchronous drop of marine survival with ecosystem changes observed in the North Atlantic in the early 1990s. Simultaneously, the proportion of early maturing salmon has increased, suggesting a change in life-history tactics.

Keywords
Atlantic salmon, Bayesian Hierarchical Model, integrated population models, life cycle, population dynamics, life history traits

Contact author
Maxime OLMOS
Agrocampus Ouest, UMR 0985 ESE INRA, Agrocampus Ouest, Ecologie et Santé des Ecosystèmes, Rennes, France.
e-mail : maxime.olmos@agrocampus-ouest.fr
Tel : +33 2 23 48 54 56 / or / +33 2 23 48 59 34