

Density dependent mortality in a European eel population: A Bayesian integrated population modelling approach

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Keywords: Abundance, capture-recapture, density-dependence, mortality, population dynamics

Abstract: Density dependent processes can have a strong impact on the dynamic of populations through their effect on one or more vital rates such as growth, mortality or fecundity. Intra-specific competition in a population is a very common mechanism of density dependence caused by limited availability of an essential resource such as space or food.

The understanding of density dependent mortality is especially interesting for species that strongly compete for food and/or space. Traditionally, an estimate of density is obtained and used as a covariate in capture-recapture models to explain the temporal variation of survival probability. Because it neglects the errors made on the measurement of the covariate, this approach is known to underestimate the effect of density.

Here, we propose to combine in a single framework a standard open capture-recapture model to estimate survival probability and a depletion model to estimate density. As a case study, we consider the European eel, for which, despite compelling evidence that it is declining throughout its range, density in catchments still remains at high levels particularly in small coastal catchments of western France.

In this work, we analyzed density-dependent mortality of an eel population quantitatively sampled by electrofishing and individually marked using PIT (Passive Integrated Tags)-tags during 10 years (1996-2005) in the Frémur. We compare the results from our approach to those obtained by using the naïve approach. Besides, the accuracy of the integrated model and its potential use for other fish species is discussed.