

Inter-annual variability in fish spatial distributions as revealed by survey data and their space-time modelling

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Abstract

Habitats are often referred to using particular terminology, e.g. potential, suitable, essential. These characteristics were associated to methods and data for their estimation. Here the focus is on realized spawning habitats and time-variability in habitat mapping. Research surveys at sea on marine fish stocks have been undertaken for several decades now. The data are time series of yearly maps of fish density. Space-time models are key to address conservation issues in a climate change context, requiring to map time-consistent habitats, predict variability in habitat use over time or assess uncertainty in limits of protected areas. Here we present how variability in fisheries survey data series can be decomposed in space and time to address these issues, using the geostatistical method of min-max autocorrelation factors (MAFs). MAFs were originally developed for analyzing multivariate data and are obtained using a specific double principal components analysis. MAFs allow to extract the most continuous spatial components that are consistent in time, together with the time series of their amplitudes. The approach is applied on the spawning distribution maps of sardine in the Bay of Biscay from 2000 to 2018. Spawning locations with higher and lower temporal variability were identified. Maps were classified in the factorial space of MAFs and groups of typical years/maps were identified. Results show that off-shore spawning habitats at shelf-break have been left repeatedly unoccupied in recent years. Potential explanations in environmental and population conditions are discussed.

Keywords:

Space-time modelling, geostatistics, spawning habitats, Biscay

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