

Geospatial dynamics of Northwest Atlantic cod and crustacean fisheries in the 1990s and 2000s: environmental and trophic impacts

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Key words: Climate change, Fisheries management, Geographically Weighted Regression, GIS, Non-stationarity, Northwest Atlantic, Spatial modelling

Abstract:

Following the early 1990s collapse of historically important groundfish species in the northwest Atlantic, there has been debate and uncertainty regarding the relative importance of fishing pressure, environmental variability, and trophic interactions in shaping the current ecosystems on the continental shelf. An implicit assumption in the analyses of species trends in this region has been that the relationships under study do not vary within given management areas (i.e., spatial stationary of the processes). Given however the complex spatial heterogeneity of the northern Atlantic shelf systems, spatial variations do occur. To investigate potential spatial variability in the relationship between the abundance and distribution of several ecologically and commercially important species (Atlantic cod, snow crab, northern shrimp) and environmental determinants (bottom temperature, salinity, depth) at concurrent and yearly-lagged intervals over the past three decades, we use a geographically weighted regression. The analysis makes use of a new comprehensive geospatial database, developed as part of the GeoCod project (Canada), which for the first time integrates fishery scientific survey data and environmental variables from all four Canadian management regions in the NW Atlantic. The geographically weighted regression results were mapped to highlight local variations in the parameter estimates, and contrasted with a global least-square regression model. The overall results of the study are discussed in terms of spatio-temporal patterns of species abundance and distribution as a function of trophic and environmental determinants.