Spatial change of dominant Baltic Sea demersal fish across two decades

Liam MacNeil[1], Frane Madiraca[2], Saskia Otto[2], and Marco Scotti[1]

[1]GEOMAR
[2]University of Hamburg

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Abstract

Aim: The range and biomass distribution of marine fish species offer insights into their underlying niches. Quantitative data are rare compared to occurrences and remain underused in species distribution models (SDMs) to explore patterns of realized niches– the actual space occupied by a species shaped by abiotic and biotic factors. Local densities drive differences in species contributions to ecological processes and ecosystem function rather than through presence alone, thus if a species growth rate is strongly controlled by macro-environmental conditions, then predicting geographical abundance or densities should be possible. Location: Baltic Sea Methods: We collated twenty years of standardized scientific bottom trawl surveys to fit an ensemble of SDMs to biomass (kg km^{-2}) of four dominant demersal species (Common dab, European flounder, European plaice, Atlantic cod) within seasonal (winter and autumn) and decadal (2001-2010; 2011-2020) time windows. Covariates were represented with high-resolution oceanographic and habitat variables. Final prediction maps for each species were produced by weighted ensemble averages. Results: This work shows four distinct cases of spatiotemporal patterns. 1) Relative stasis in dab that is linked to the macro-environmental salinity gradient in the western Baltic Sea. 2) Flounder biomass showed spatial seasonality alongside increasing trends in the western Baltic Sea and declines in Bornholm Basin deeps. 3) Plaice have broadly increased in biomass density throughout the western Baltic Sea towards present, associated with bottom salinity and temperature. 4) Both juvenile and adult cod ([?]35 cm) declined in biomass and distribution, greatest among juvenile cod in the Gdańsk deeps and for adult cod in Bornholm Basin by 2011-2020. Main Conclusions: This study maps biomass of the dominant Baltic Sea demersal fish, including seasonally-explicit patterns available from survey data. The biogeographic patterns described here expand beyond common occurrence data and suitability maps, which rarely discriminate between areas of high and low abundance.

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