Title

Is climate change biasing survey abundance indices? A simulation study starting point.

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Abstract:

Stock assessments use abundance estimates derived from stratified random bottom trawl data. To accurately represent true abundance, catches of a species must contain a low enough noise level to allow for a discernible pattern and all strata in which the population exists should be sampled. These assumptions might be violated given enough noise in the sampling process and/or climate change causing a population to move into previously uninhabited strata. Using the R package *MixFishSim*, we have developed data-driven spatial models for Yellowtail Flounder, Cod, and Haddock on Georges Bank to allow examination of these assumptions through simulation. Movement rates combine species-specific static habitat preferences with temperature tolerances. Habitat preferences were derived from niche models relating bottom trawl catches to environmental covariates. A repeating yearly temperature pattern produces repeating spatial biomass distributions in a given week, while a temperature gradient that increases on average over time results in spatial preferences that evolve throughout a given simulation. We examined several temperature scenarios and population trends to create simulated spatial time series datasets for each species. We then conduct stratified random sampling on model output and compare abundance estimates using the stratified mean to those using a common model-based approach that allows inclusion of environmental covariates (VAST). Our focus is on the ability of contemporary indexing methods to track population trends under shifting spatial preferences. Results highlight conditions that can result in biased indexing estimates and demonstrate the value of including spatial covariates in abundance estimates.