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*Statistical estimation of the moment dynamics of ecological communities to detect regime changes*

As anthropogenic changes increasingly shape the global ecosystem, more and more ecological communities are undergoing regime shifts (abrupt changes from one persistent ecological state to another). Current statistical techniques for detecting regime shifts have focused on detecting abrupt changes in the abundances of single species, ignoring the possibility of more complex community dynamics during shifts such as transient responses, the existence of slow variables, or compositional rearrangements. Here I argue that regime shifts are more readily detectable from among-species statistical moments of rates of change; i.e. means and variances of instantaneous rates of change among species. I show how it is possible to estimate these rates of change from noisy community data by using a novel penalized spline / Markov Random Field tensor product smoother that fits species-specific time series while simultaneously penalizing species towards a common trend, using long-term monitoring data from the collapse of the Newfoundland Atlantic Cod stocks as an example.