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Nonlinear coupling determines how much "ecosystem" is needed for Ecosystem Based Management

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Ecosystem-based management (EBM) is a much talked-about alternative to single-species management, but it is rarely used due to the inherent complexity of ecosystems and the universe of potential factors that might influence a target species. Using next generation nonlinear forecast tools (dewdrop and cubist regression), we are able to sort biological and physical time series into groups that are functionally coupled. These techniques determine the number of variables (degrees of freedom) driving the dynamics of any one series, and incorporate those variables into a nonlinear model of the system if their time series are available. The techniques also work even if some or none of those driving variables are available. We apply this method to a large data set for fish species in the California Current (CalCOFI database) to demonstrate functional physical-biological coupling and the forecast power of these techniques, and to infer how long ecosystem data must be collected in order for similar models to be developed in less exhaustively studied regions.