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Resilience and stability of a pelagic marine ecosystem - DTU Orbit (08/11/2017)

Resilience and stability of a pelagic marine ecosystem

The accelerating loss of biodiversity and ecosystem services worldwide has accentuated a long-standing debate on the role of diversity in stabilizing ecological communities and has given rise to a field of research on biodiversity and ecosystem functioning (BEF). Although broad consensus has been reached regarding the positive BEF relationship, a number of important challenges remain unanswered. These primarily concern the underlying mechanisms by which diversity increases resilience and community stability, particularly the relative importance of statistical averaging and functional complementarity. Our understanding of these mechanisms relies heavily on theoretical and experimental studies, yet the degree to which theory adequately explains the dynamics and stability of natural ecosystems is largely unknown, especially in marine ecosystems. Using modelling and a unique 60-year dataset covering multiple trophic levels, we show that the pronounced multi-decadal variability of the Southern California Current System (SCCS) does not represent fundamental changes in ecosystem functioning, but a linear response to key environmental drivers channelled through bottom-up and physical control. Furthermore, we show strong temporal asynchrony between key species or functional groups within multiple trophic levels caused by opposite responses to these drivers. We argue that functional complementarity is the primary mechanism reducing community variability and promoting resilience and stability in the SCCS.

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