

Interactive effects of multiple stressors vary with consumer interactions, stressor dynamics and magnitude

Mischa Turschwell¹, Roman Ashauer², Max Campbell¹, Rod Connolly¹, Sean Connolly³, Isabelle Cote⁴, Frederik De Laender⁵, Michelle Jackson⁶, Mira Kattwinkel⁷, Chrystal Mantyka-Pringle⁸, Ralf Schaefer⁹, Michael Sievers¹⁰, Paul Van den Brink¹¹, and Chris Brown¹

¹Griffith University

²University of York

³Smithsonian Tropical Research Institute

⁴Simon Fraser University

⁵Namur University

⁶Oxford University

⁷University Koblenz - Landau

⁸Wildlife Conservation Society Canada

⁹University of Koblenz Landau - Campus Landau

¹⁰Griffith University - GC Campus

¹¹Wageningen University

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Abstract

Predicting the impacts of multiple stressors is important for informing ecosystem management, but is impeded by a lack of a general framework for predicting whether stressors interact synergistically, additively, or antagonistically. Here we use process-based models to study how interactions generalise across three levels of bio-logical organisation (physiological, population, and community) for a simulated two-stressor experiment on a seagrass model system. We found that the same underlying processes could result in synergistic, additive or antagonistic interactions, with interaction type depending on initial conditions, experiment duration, stressor dynamics, and consumer presence. Our results help explain why meta-analyses of multiple stressor experimental results have struggled to identify predictors of consistently non-additive interactions in the natural environment. Experiments run over longer temporal scales, with treatments across gradients of stressor magnitude, are needed to identify the processes that underpin how stressors interact and provide useful predictions to management.

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