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Parameterization of a density-dependent structured population model for *Daphnia magna* using multi-scale data

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Abstract:
A concern for environmental hazard assessments is that hazard predictions for population/ecosystems are derived solely from the evaluation of toxicity data at the organism level. We developed a structured population model that can be used to propagate the assessment of *Daphnia magna* organismal responses, i.e., to environmental change, to the population level, thereby enabling the causal association of organismal responses to ecosystems adversity. We developed a continuous structured population model based on the Sinko-Streifer equations and used multi-scale experimental data, i.e., individual- and population-level data, for model validation. Our model describes how fecundity and survival rates are affected by both time-varying density-independent factors, such as age, and density- dependent factors, such as competition. We performed uncertainty analysis and parameter subset selection analysis to test which density-dependent parameters can be estimated with a high degree of confidence. Further, we performed a sensitivity analysis to understand how changes in fecundity and survival rates affect population size and age-structure. This work is performed in collaboration with environmental toxicologists at North Carolina State University.