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Abstract Title:
ESTIMATING STAGE-SPECIFIC VITAL RATE RESPONSES TO STRESS WITHIN MIXED AGE POPULATIONS OF THE OPOSSUM SHRIMP AMERICAMYSIS BAHIA USING DIGITAL IMAGING

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Most observations of stressor effects on marine crustaceans are made on individuals or even-aged cohorts. Results of these studies are difficult to translate into ecological predictions, either because life cycle models are incomplete, or because stressor effects on mixed age populations may differ from those observed in cohort studies. This problem is evident in several important environmental applications of population ecology, including ecological risk assessment of chemicals and futures analyses of ocean acidification. In particular, investigators have acknowledged the need for life cycle approaches in predicting adaptive responses to changing environments. To address this need, we have developed an observational scheme that allows estimation of stage-specific vital rates (e.g., juvenile survival, adult survival, fecundity) from observations of mixed age *Americamysis bahia* populations. Image analysis of video frame captures has enabled us to do reliable temporal in vivo monitoring of test populations. We used this system to examine life cycle responses to four levels of resource limitation (i.e., feeding rates), which is an oft-cited complication in applied population ecology. Based on our analysis, more than 95% of the treatment effect on population growth rate was due to changes in adult survival. However, we also detected complex compensatory responses, such that impairments in one part of the life cycle were partially offset by improvements in other vital rates. This contrasts with our cohort-based results, where resource effects on each vital rate were always positive. Our study suggests that emphasis in stressor-response studies on early life stages and even-aged cohorts may miss important demographic responses and should be augmented by observations of intact populations, especially as methods such as ours become more available.

Keywords:
ecological risk assessment; population model; crustacean; mysid; Americamysis bahia; demography; matrix model; inverse demographic estimation; experiment; survival; fecundity; population growth rate; cohort; dose-response

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