Can Evolutionary Responses to a Disturbance Alter Population Dynamics?

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Though evolution is often thought to occur on timescales that are much longer than the population dynamics, this is not always the case. For instance, prolonged exposure to a disturbance such as a toxicant has the potential to result in rapid evolution of toxicant resistance in many short-lived species. This evolution may alter the population dynamics, such as enabling a population to persist at higher levels of the toxicant than is possible without evolution. In this talk I will present an application of evolutionary game theory to discrete-time models to obtain Darwinian equations that couple population and evolutionary dynamics. I will first examine how persistence outcomes for surrogate Daphnia species may change as a result of evolution. These results highlight the complexities involved in using surrogate species to examine toxicity. Since this model considers the population in isolation, it does not take into account how evolution may alter species interactions. To examine this issue, we develop an evolutionary, discrete-time predator-prey model in which a prey species evolves in response to a toxicant but the predator does not due to different time scales. We provide stability results for this model and consider how evolution of toxicant resistance may impact the population dynamics of both species.