
XINGFU ZOU, University of Western Ontario

Evolution and adaptation of anti-predation response of prey in a two-patchy environment

When perceiving a risk from predators, a prey may respond by reducing its reproduction and decreasing or increasing (depending on the species) its mobility. We formulate a patch model to investigate the aforementioned fear effect which is indirect, in contrast to the predation as a direct effect, on the prey population. We consider not only cost but also benefit of anti-predation response of the prey, and explore their trade-offs as well as the impact of the fear effect mediated dispersals of the prey. In the case of constant response level, if there is no dispersal and for some given response functions, the model indicates the existence of an evolutionary stable strategy (ESS) which is also a convergence stable strategy (CSS) for the response level; and if there is dispersal, the analysis of the model shows that it will enhance the co-persistence of the prey on both patches. Considering the trait as another variable, we continue to study the evolution of anti-predation strategy for the model with dispersal, which leads to a three-dimensional system of ordinary differential equations. We perform some numerical simulations, which demonstrate global convergence to a positive equilibrium with the response level evolving toward a positive constant level, implying the existence of an optimal anti-predation response level. Interestingly, it is observed that this optimal response level may not agree with the ESS. This is a joint work with Ao Li.