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On evolutionary stability in some population games

The classical models of population dynamics (e.g., the Lotka-Volterra predator-prey model) assume that interaction strength is fixed and independent of population densities. However, empirical evidence suggests that both prey and/or predators change their behavior with changes in population numbers. For example, an increase in predator numbers often decreases prey activity. Such plasticity in animal behavior leads to variable interaction strength that can strongly influence population dynamics. As predators and prey often play avoidance game (i.e., prey try to avoid predators while predators try to find prey), to solve this game methods of evolutionarily game theory are often used. In particular, it is assumed that the optimal solution to such a game corresponds to the evolutionarily stable strategy. By definition, such a strategy cannot be invaded by rare mutants, and from this respect it is the ultimate outcome of evolution. However, the classical theory does not consider changes in population numbers and in such a dynamic setting it is not a priori clear, if evolutionarily stable strategies can be invaded by rare behavioral mutants when population dynamics are considered. In this talk we will show that this can happen, although behavioral mutants cannot replace residents. However, a polymorphism can arise. Whether this happens or not, depends on particular dynamics and food web topology.