Moment Equations for the Evolution of Quantitative Traits in Space

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The importance of genetic change, and in particular adaptive evolution, during biological invasions is widely acknowledged, yet has to date received little attention from theoreticians. Here we present analysis of a set of models for the moments of a quantitative trait (i.e. a continuous random variable like body size) in a population that disperses in a continuous spatial habitat with a spatially varying trait optimum, building on work of Kirkpatrick and Barton (1997) and others. We focus on (discrete-time) integrodifference models incorporating "heavy-tailed" dispersal, which is known to strongly influence the speed of traveling wave solutions, representing invasions, in purely ecological models without a genetic component. We obtain both traveling wave speeds and, when maladaptation limits the extend of an invasion, properties of the resulting localized (i.e. range-limited) population. These are contrasted with existing results (Kirkpatrick/Barton 1997, Barton 2001, Garcia-Ramos/Rodriguez 2002) for partial differential equation models representing diffusive movement. The results advance understanding of how dispersal patterns interact with genetics and environmental conditions to determine the extent of a species' range.

Joint work with A. Castorena.