Anne Seppänen
Department of Mathematics, FI-20014 University of Turku, Finland
e-mail: anne.seppanen@utu.fi
Kalle Parvinen
Department of Mathematics, FI-20014 University of Turku, Finland
e-mail: kalparvi@utu.fi
John Nagy
Department of Life Sciences, Scottsdale Community College, Scottsdale, AZ 85256-2626, USA
e-mail: john.nagy@sccmail.maricopa.edu

Evolution of Dispersal and Global Climate Change

Global climate change (GCC) can challenge species' survival by shifting and (or) shrinking suitable habitats, leading to habitat fragmentation. American pikas (*Ochotona princeps*)—small, talus-dwelling, montane lagomorphs physiologically adapted to cold climates—are thought to face precisely this sort to threat from GCC. Recent climate changes appear to have decreased suitability of pika habitat in both the Great Basin and adjacent Sierra Nevada[1,2]. On the other hand, pika populations in both these regions appear robust[3]. One hypothesis explaining these contradictory observations suggests that pikas may adapt to climate change by evolving compensatory dispersal strategies that blunt the impact of fragmentation.

Here we address this hypothesis using adaptive dynamics[4] to study the evolution of dispersal strategies in pikas. Inspired by the models of Metz and Gyllenberg[5] and Parvinen[6], we construct a novel model of pika metapopulation dynamics and derive a fitness measure of a rare mutant in an environment set by the resident. We use a semi-discrete time approach with discrete phases defined by sequential breeding seasons and continuous within-phase processes (e.g. emigration, immigration). Local catastrophes occur with a rate which can depend on the patch population size. We consider climate change as shifts in model parameters, including fecundity, survival and catastrophe rates along with dispersal cost, and analyze how such changes affect evolutionarily stable dispersal strategies.

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