ACMS Applied Math Seminar

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Thursday, October 25, 2018
154 Hurley Hall
3:30 – 4:30 PM

Examining Population Recovery and Persistence Following Environmental Disturbances

We develop non-autonomous matrix models to examine the possible long-term effects of environmental disturbances, such as oil spills, floods, and fires, on population recovery and persistence. To model the effects of a disturbance, we assume vital rates are reduced for a period of time, after which they recover to their original values. We first examine population recovery following a single disturbance, where recovery is defined to be the return to the pre-disturbance population size. We apply matrix calculus methods to derive explicit formulas for the sensitivity of the recovery time with respect to properties of the population and the disturbance. We then develop a model to consider the effect of repeated disturbances on population persistence. This model uses a two-state Markov chain to describe the frequency and average length of effect of the disturbances. We derive an approximation for a population's stochastic growth rate in order to examine how disturbances may impact species persistence. Motivated by the 2010 Deepwater Horizon oil spill, we apply the results of both models to examine the possible response of a sperm whale population to environmental disturbances.

The Department of Applied and Computational Mathematics and Statistics

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