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An age-structured population model with state-dependent delay: derivation and numerical integration

We present an age-structured population model that accounts for the following aspects of complex life cycles: (1) There are juvenile and adult stages, (2) only the adult stage is capable of reproducing, (3) cohorts of juveniles can transition to the adult stage when they have consumed enough nutrition and (4) the juvenile and adult populations consume different limited food sources. Taking all of these into account leads to a new mathematical model that cannot be directly analyzed using the established framework of functional differential equations. The model consists of a partial differential equation with a nonlinear boundary condition and state-dependent delay due to a threshold condition. In this talk we present the derivation of the model, its properties and a numerical scheme to integrate the equations.

This is joint work with Nemanja Kosovalic and Jianhong Wu.