John E. Franke* (franke@math.ncsu.edu), Department of Mathematics, Box 8205, North Carolina State University, Raleigh, NC 27695-8205, and Matthew A. Morena. Predicting Attenuant and Resonant 2-Cycles in Periodically Forced Discrete-Time 2-Species Population Models. Preliminary report.

Periodic environments are commonly observed in nature and may either enhance or suppress a population. We study the responses of two competing discretely reproducing populations to periodic fluctuations in four parameters. Two of these parameters are related to a nontrivial equilibrium (carrying capacity) and the other two are quite arbitrary and could be related to environmental factors or growth rates. We prove that small, 2-periodic fluctuations in the four parameters support 2-cyclic oscillations of the populations. We then develop signature functions for predicting the responses of the populations to 2-periodic fluctuations in the environment. Each signature function is the sign of a weighted sum of the relative strengths of the oscillations of the perturbed parameters. Periodic environments are favorable for the total biomass and for each species if the corresponding signature function is positive but are deleterious when the corresponding signature function is negative. We compute the signature functions for three classical discrete-time, two species population models, and then determine regions in parameter space which are either favorable or detrimental to the populations. The three 2-D models studied are Logistic, Ricker, and Beverton-Holt type models. (Received September 22, 2010)