Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **14 (2007)** 81-87

GLOBAL DYNAMICS OF A NONAUTONOMOUS PREDATOR-PREY SYSTEM WITH DISPERSION [1]

Fang Zhang and Xiao-Qiang Zhao

Department of Mathematics and Statistics
Memorial University of Newfoundland, St. John's, NL A1C 5S7

Abstract. In this paper, we study the global dynamics of a nonautonomous predator-prey system with dispersion. By appealing to the theory of nonautonomous semiflows, we establish sufficient conditions for uniform persistence and global extinction. The global stability of positive periodic solution is also obtained via Liapunov function method.

Keywords. Predator-prey model, persistence, extinction, periodic solution, global stability.

AMS (MOS) subject classification: 34C25, 34D05, 92D25

1 Introduction

One of the fundamental problems in population dynamics is to study the evolutionary (long-term) behavior of the interacting species. In order to take into account the dispersal phenomenon of species, Levin [10] presented an autonomous Lotka-Volterra type model in a patchy environment. Kishimoto [9] and Takeuchi [13] also studied this kind of model, but all the coefficients in their systems are constants. For more autonomous models in patchy environments, we refer to [1, 5, 7] and references therein. However, it is much more realistic to assume that all the intraspecific coefficients and dispersive coefficients depend on time. In addition, it is natural to assume that these coefficients are periodic with a common period due to the seasonal effects. In 1998, Song and Chen [12] analyzed the following model

$$\begin{cases} \dfrac{dx_1}{dt} = x_1(a_1(t) - b_1(t)x_1 - c(t)y) + D_1(t)(x_2 - x_1) \\ \dfrac{dx_2}{dt} = x_2(a_2(t) - b_2(t)x_2) + D_2(t)(x_1 - x_2) \\ \dfrac{dy}{dt} = y(-d(t) + e(t)x_1 - q(t)y). \end{cases} \tag{1.1}$$

Here x_1 and y, respectively, are population densities of prey species x and predator species y in patch 1, and x_2 is the density of prey species x in patch 2. Predator species y is confined to patch 1, while the prey species x can disperse

[1]Supported in part by the NSERC of Canada.