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Population systems with nonlinear discrete diffusion terms

Manuel Gamez [a] and Antonio Tineo [b,*]

[a] *Departamento de Estadística y Matemática Aplicada, Universidad de Almería, La Cañada de San Urbano s/n, Spain*

[b] *Departamento de Matematicas, Facultad de Ciencias, Universidad de Los Andes, Merida, Venezuela*

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0. Introduction

In this paper, we study the asymptotic behaviour of the following periodic population system, with nonlinear discrete diffusion terms:

$$\begin{aligned} x_i' &= D_i(t, x_1, \ldots, x_n) + x_i f_i(t, x_i, y_i), \\ y_i' &= E_i(t, y_1, \ldots, y_n) + y_i g_i(t, x_i, y_i), \quad 1 \leqslant i \leqslant n, \end{aligned} \tag{0.1}$$

where $f_i, g_i : \mathbb{R} \times \mathbb{R}_+^2 \to \mathbb{R}$ are continuous functions which are T-periodic in t and locally Lipschitz continuous in (x_i, y_i) and $D = (D_1, \ldots, D_n)$, $E = (E_1, \ldots, E_n)$ are T-periodic nonlinear diffusion functions in the sense of [9]. That is, $D(t, x)$, $E(t, x)$ are positive homogeneous in x, cooperative and irreducible [9]. As usual, x_i, y_i represent the population density of the species at the patch i. We will assume that

(H_1) $f_i(t, x, y)$ is strictly decreasing in x and decreasing in y.
(H_2) $g_i(t, x, y)$ is strictly decreasing in y.

* Corresponding author.
E-mail address: atineo@ula.ve (A. Tineo).

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