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UNIFORM PERSISTENCE IN REACTION-DIFFUSION PLANKTON MODELS

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ABSTRACT. In this paper, homogeneous Neumann problem for reaction-diffusion systems of plankton-nutrient models with instantaneous nutrient recycling is considered. By using the main theorem of Hale and Waltman [**11**], sufficient conditions for uniform persistence are derived.

1. Introduction. Reaction-diffusion equations have been extensively used to model ecological phenomena. For modeling of plankton dynamics, we refer to Leven and Segel [**18**], Mimura [**20**], Okubo [**21**], Wroblewski and Richman [**24**], Freedman and Ruan [**7**] and references cited therein.

In order to model the dynamics of plankton, Wroblewski and Richman [**24**] used a set of simplified reaction-diffusion equations which has properties characteristic of the pelagic marine ecosystem. They examined the response of the plankton dynamics to perturbations in the physical oceanographic environment caused by wind forcing. The model they constructed is consisted of three components, herbivorous zooplankton (Z), phytoplankton (P) and dissolved nutrients (N). They supposed that the nutrients are not limiting and neglected sinking losses of phytoplankton, vertical migration by zooplankton and vertical advection of Z, P and N by an organized flow. Hence the system of their model is closed.

An ecosystem is never totally closed to material fluxes from the outside, there are generally inputs of nutrients to the system, as well as losses from the system. In this paper, we consider an open system represented by a set of reaction-diffusion equations. Based on the model constructed by Wroblewski and Richman [**24**], we introduce a constant nutrient input rate and different constant washout rates to the system. We also use a general class of functions to describe nutrient uptake and functional response. The question of persistence is studied.

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