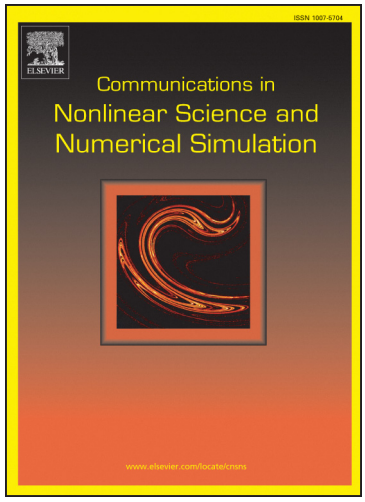

A Reaction-Diffusion Model of the Darien Gap Sterile Insect Release Method

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Abstract

The Sterile Insect Release Method (SIRM) is used as a biological control for invasive insect species. SIRM involves introducing large quantities of sterilized male insects into a wild population of invading insects. A fertile/sterile mating produces offspring that are not viable and the wild insect population will eventually be eradicated. A U.S. government program maintains a permanent sterile fly barrier zone in the Darien Gap between Panama and Columbia to control the screwworm fly (*Cochliomyia Hominivorax*), an insect that feeds off of living tissue in mammals and has devastating effects on livestock. This barrier zone is maintained by regular releases of massive quantities of sterilized male screwworm flies from aircraft. We analyze a reaction-diffusion model of the Darien Gap barrier zone. Simulations of the model equations yield two types of spatially inhomogeneous steady-state solutions representing a sterile fly barrier that does not prevent invasion and a barrier that does prevent invasion. We investigate steady-state solutions using both phase plane methods and monotone iteration methods and describe how barrier width and the sterile fly release rate affects steady-state behavior.

Keywords: `reaction-diffusion model`, `steady-state solutions`,, `sterile insect release method`