

Optimizing impulsive releases: a species competition model

Jéssica C.S. Alves, Sergio M. Oliva, Christian E. Schaerer

Abstract

This study focuses on optimizing species release S_2 to control species population S_1 through impulsive release strategies. We investigate the conditions required to remove species S_1 , which is equivalent to the establishment of S_2 . The research includes a theoretical analysis that examines the positivity, existence, and uniqueness of solutions, the conditions ensuring global stability, and a sufficient condition for controlling the S_1 - free solution. In addition, we formulate an optimal control problem to maximize the effectiveness of S_2 releases, manage the population of S_1 , and minimize the costs associated with this intervention strategy. Numerical simulations are conducted to validate the proposed theories and allow visualization of population dynamics under various release scenarios.