



Harvesting Strategies in the Migratory Prey-Predator Model with a Crowley-Martin Type Response Function and Constant Efforts

Didiharyono, Syamsuddin Toaha*, Jeffry Kusuma and Kasbawati

Department of Mathematics, Hasanuddin University, Makassar, 90245, Indonesia

Received: October 10, 2022; Revised: December 21, 2022

Abstract: This paper deals with the dynamics of prey and predator populations in the permitted and prohibited areas of harvesting with a Crowley-Martin response function. The predator can migrate easily into both areas. The prey and predator populations in the permitted area are harvested with constant efforts. The existence and stability of the interior equilibrium point are studied. The stable interior equilibrium point is connected with maximum profit. The stability of the interior equilibrium point is analysed locally using the linearization method and eigenvalues. Due to the complexity, the simulation is carried out using the relevant parameter values to determine the existence of a stable interior equilibrium point and profit function. From simulation, there exists an ordered pair of harvesting efforts that gives a stable interior equilibrium point and also maximizes the profit function. Harvesting in prey and predator populations in the permitted area can prevent the populations from extinction and also provide maximum sustainable profit. The trajectories of prey and predator populations are plotted to visualize the dynamical behaviour for a given span of time. The surface of profit function is also plotted to view the maximum profit.

Keywords: *prey-predator; harvesting effort; migration; stability; Crowley-Martin; maximum profit.*

Mathematics Subject Classification (2010): 34Dxx, 70Kxx, 93-XX.

* Corresponding author: <mailto:syamsuddint@gmail.com>