Dynamics of Continuous, Discrete and Impulsive Systems Series B: Applications & Algorithms 30 (2023) 375-394 Copyright ©2023 Watam Press

DYNAMICS ANALYSIS OF THE COEXISTENCE EQUILIBRIUM FOR A DIFFERENTIAL-ALGEBRAIC BIOLOGICAL ECONOMIC SYSTEM WITH THE HYBRID FUNCTIONAL RESPONSE

M.C.Benkara Mostefa¹ and N.E. Hamri²

¹Department of Mathematics University of Mentouri Constantine1, Constantine, Algeria ²Mathematics and Their Interactions Laboratory (Melilab) University Center of Mila, Mila, Algeria

Abstract. The goal of the paper is to look at the dynamics of a bio-economic predatorprey system that only uses harvesting and the hybrid Holling II and Bedding-DeAngelis response function. Because of the economic revenue, the system is equipped with an algebraic equation. To illustrate some of the important outcomes, we provide a full mathematical analysis of the proposed model. The boundedness and positivity of the model's solutions were investigated. The bio-economic system's coexistence equilibrium have been thoroughly researched, and the model's behavior around them has been explained using qualitative theory of dynamical systems (such as local stability and Hopf bifurcation). The obtained results provide a beneficial foundation for comprehending the economic revenue v role. When the profit v is less than a specific critical value v^* , we prove that a positive equilibrium point is locally asymptotically stable. It is clear from our research. Our research indicates that economic revenue has the potential to stabilize the system (survival of all species).

Keywords. predator-prey system, equilibrium point, stability, algebraic differential equations, Hopf bifurcation.

AMS (MOS) subject classification: 34D20; 34C23; 37N25.

1 Introduction

There is a lot of interest in understanding and designing bio-economic models for biodiversity for the long-term benefit of humanity. Researchers are working to develop certain potentially beneficial results in order to ensure the ecosystem's long-term viability and prosperity.

The investigation of such dynamics has been the focus of a lot of research. The dynamical behavior of a type of predator-prey ecosystem was explored using numerous differential equations and an algebraic equation [15, 19].