

## SPATIOTEMPORAL BASED PREDATOR-PREY HARVESTING MODEL FOR FISHERY WITH BEDDINGTON-DEANGELIS TYPE FUNCTIONAL RESPONSE AND TAX AS THE CONTROL ENTITY

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**Abstract.** For the present article, an aquatic ecosystem in a spatiotemporal domain is formulated. In the model formulation, it is considered that the prey fish is predated by predator fish as well as harvested using efforts expanded by the human to grow fishery industries in perspective of financial intrigue. To depict this situation we have considered four state variables, first two are prey and predator fish, and the interaction between both the species is of Beddington De-Angelis type. The other two are the efforts expanded to harvest prey fish population and the industries grown by effort expanded and the alternative industries with respect to time. The Hopf-bifurcation, bionomic equilibrium, optimal tax policy, Turing instability, higher order stability analysis and the patterns formulation are the measure findings of the work.

**Keywords.** Predator-Prey system, Fishery, Conservation, Industries and Spatiotemporal.

**AMS (MOS) subject classification:** 37N40, 92D25, 92D40, 93C15, 93C20, 97Mxx

## 1 Introduction

A standout amongst the most overpowering topic in applied ecology and mathematical ecology is the interaction between predator and prey populations. To model biological phenomenon, mathematical models are used to mention the system dynamics over the past few decades. Authors Kar and Batayal [25], explain the importance how mathematical model continues to serve as an indispensable tool for future investigation. In ecology, predator-prey relationship is a standout amongst the most remarkable part to understand the dependence of one on another. Lotka in the year 1925 describes the dynamic coupling between predator abundance and prey abundance [30]. The detailed description of different functional responses has discussed in [36]. As per [36] the structure of prey habitat also causes variation in functional response. The Lotka-Volterra [27, 33] system commonly known as the