QUALITATIVE ANALYSIS OF DYNAMICAL COMPLEXITIES ON APPLIED BIOECONOMIC MODELS IN PREDATOR PREY FISHERY

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Abstract

Management of ecological and biological resources like fish species, forests, etc. must be carefully monitored to prevent overexploitation and species extinction. Overexploitation of any species disrupts its ecology. Overexploitation of biological resources for commercial gain must be considered biologically and economically. To prevent environmental disasters and economic irresponsibility and income losses, biological and economic overexploitation must halt. Concerns and laws on ecological and biological resource exploitation must prevent biological and economic overexploitation. Quantitative modeling that considers biological and economic factors will help identify these issues and policies.

Non-linear mathematical models based on real occurrences are being studied in mathematical biology. These research help explain fish species' dynamical behaviour, including selective and non-selective harvesting, presence of toxic substances, Holling Type-II functional response, and more.

My study focuses on mathematical models for commercially harvested mixed species marine fisheries management. Developing concerns and policies to prevent biological and economic overexploitation of fish species is the main goal of such modeling.

In this thesis, fishery resource models were utilised to study predator-prey interactions and human activities like harvesting. Nonlinear dynamics features including local stability, persistence, and global stability are examined here. Local stability of equilibrium points can reveal the system's distinguishing traits. Here, we examine how well-regulated fish capture affects the ecology. The model is now an optimal control problem that considers harvesting socioeconomics. Applying Pontryagin's maximum principle to a modified catch rate function maximises net harvesting revenue while maintaining system stability. The study found that appropriate fish population harvesting stabilised systems.

Keywords: Fishery resource management, Functional response, Local and global stability, Lyapunov function, Optimal harvesting policy.

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