Bio-Economics of a Renewable Resource in the Presence of Pollution: The Problem of Optimal Effort Allocation

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Abstract: This paper deals with the bio-economics of a renewable resource in a polluted environment. A decline in the revenue due to pollution drives the harvester to allocate a part of the total effort capacity towards pollutant inflow reduction. Hence, the interest is to find an optimal allocation of the available effort capacity between harvesting and pollutant inflow reduction so that the revenue is as large as possible. Therefore, we formulate the optimal harvest problem on an infinite horizon, and it is solved using the standard techniques of optimization. We verify the applicability of the results by considering some practical examples.

Keywords: *bio-economics; renewable resource; pollution; effort allocation; inflow reduction.*

Mathematics Subject Classification (2010): $34H05, 49J15, 92D25$.

1 Introduction

The link between renewable resource harvesting and pollution has occupied the attention of researchers and scientists from various disciplines such as economics, biology, engineering, and mathematics. Pollution of water bodies (such as rivers and lakes from the discharge of municipal sewage, septage, industrial chemicals, agricultural run off containing pesticides, etc.) affects the livestock surviving in that environment. Consequently, the economy dependent on the exploitation of such stock suffers as the presence of pollution in the environment affects the health, longevity, and reproductivity of biomass.

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