

INSTITUTUL DE MATEMATICA “SIMION STOILOW” AL ACADEMIEI ROMANE

Seminarul de Teoria Potentialului

Harvesting of populations in stochastic environments

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Abstract: We consider the harvesting of a population in a stochastic environment whose dynamics in the absence of harvesting is described by a one dimensional diffusion. Using ergodic optimal control, we find the optimal harvesting strategy which maximizes the asymptotic yield of harvested individuals. When the yield function is the identity, we show that the optimal strategy has a bang-bang property: there exists a threshold $x^* > 0$ such that whenever the population is under the threshold the harvesting rate must be zero, whereas when the population is above the threshold the harvesting rate must be at the upper limit. We provide upper and lower bounds on the maximal asymptotic yield, and explore via numerical simulations how the harvesting threshold and the maximal asymptotic yield change with the growth rate, maximal harvesting rate, or the competition rate.

We also show that, if the yield function is C^2 and strictly concave, then the optimal harvesting strategy is continuous, whereas when the yield function is convex the optimal strategy is of bang-bang type. This shows that one cannot always expect bang-bang type optimal controls.