Moments and probability density of threshold crossing times for populations in random environments under sustainable harvesting policies

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Abstract Stochastic differential equations are used to model the dynamics of harvested populations in random environments. The main goal of this work is to compute, for a particular fish population under constant effort harvesting, the mean and standard deviation of first passage times by several lower and upper thresholds values. We apply logistic or logistic-like with Allee effects average growth dynamics. In addition, we present a method to obtain the probability density function of the first passage time by a threshold through the numerical inversion of its Laplace transform.

Keywords Allee effects · Constant effort harvesting · Laplace transform · Logistic growth · Stochastic differential equations · Threshold crossing times

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1 Introduction