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SUB-OPTIMAL HARVESTING POLICIES WITH STEPWISE EFFORT IN A RANDOM ENVIRONMENT

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In a randomly varying environment, we can describe the evolution of a fished population size using stochastic differential equations. Previously (see [2, 5, 6]), we have compared the profit performance of two harvesting policies, one with variable harvesting effort, called optimal policy, and the other with constant harvesting effort, called optimal sustainable policy. The former is characterized by fast and abrupt variations of the harvesting effort associated with the frequent variations in population size due to the random environmental fluctuations. This type of policy is inapplicable due, for instance, to the logistics of the fisheries being incompatible with abrupt and frequent changes in the harvesting effort. It also poses social problems during the periods of no or low harvesting effort. Furthermore, this type of policy requires the knowledge of the population size at each instant and estimating population size is an inaccurate, lengthy and expensive task. The optimal sustainable policy considers the constant application of the same harvesting effort and leads to population sustainability, as well as to the existence of a stationary probability density for the population size (see [1]). This policy has the advantage of being easily applicable and there is no need to estimate the population size at every instant. The performance of the two policies was compared in terms of the profit over a finite time horizon. Using data based on a real fished population, we show that there is only a slight reduction in profit by using the optimal sustainable policy (based on constant effort) instead of the inapplicable optimal policy (based on variable effort).

Since the optimal variable effort policy is not applicable, we present here *stepwise policies* (see [3, 4]), which are sub-optimal policies where the harvesting effort is determined at the beginning of each year (or of each biennium) and kept constant throughout that year (or biennium). These policies are not optimal and pose social problems common to the optimal policies, but have the advantage of being applicable, since the changes in harvesting effort are much less frequent and are compatible with the fishing activity. Furthermore, even though estimating population size is still required, that needs to be done less frequently. We present

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the comparison in terms of profit of these stepwise policies with the two previously mentioned policies.

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