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The Influence of Serially Correlated Shocks on the Conservation of Fish Stocks under Open Access Harvesting

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Abstract

Renewable resources like fish stocks randomly fluctuate due to the influence of unpredictable environmental variability. Random environmental events can have consequences on the livelihood of fishing communities. Considering that with climate change severe weather events are expected to become more frequent, studying how disturbances affect the dynamics of a natural resource like fish stocks is particularly important. Standard models of renewable resource allocation under uncertainty typically assume that environmental disturbances are identically and independently distributed. When weather patterns impact environmental conditions, shocks may be serially correlated. This serial correlation has implications for the long run conservation of harvested renewable resources. This paper investigates the dynamics of a harvested, open-access renewable resource whose productivity is influenced by serially correlated random environmental disturbances. The main question addressed in the paper is: how does the expected value of stock escapement depend on the parameters that determine the distribution of environmental shocks? In answering this question I also characterise how the maximum and minimum escapement policy functions depend on these parameters. An application of the conceptual framework to the American lobster fishery of Long Island Sound is used to address these issues qualitatively and quantitatively. In the application, the model is parameterised using an econometric model of population dynamics for the Long Island Sound lobster fishery. In this application shocks are negative correlated and transient so a high current productivity shock decreases the probability of high future shocks. The results suggest that conservation is promoted by increases in both the autocorrelation of the random shocks, as well as the variance of the uncorrelated error term. The conclusions provide useful information regarding how serial correlation in environmental disturbances impacts the conservation of open–access renewable resources.

Keywords: Autocorrelated shocks, bioeconomic model, Open access

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