Title: **Optimizing Dynamic Catch Quotas in Stock Fluctuating Fisheries**

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Abstract: Historical long term changes in stock abundance have been related to climatic changes, and fish stocks seem to fluctuate over time in relation to warm and cold periods in ocean waters. Large fluctuations of fish stocks and long term changes in human harvest of marine resources are well known from long before modern exploitation started and harvesting technology became efficient enough to make significant stock reductions. This paper presents a simple approach for including periodic fluctuations in carrying capacity and recruitment long term patterns. This is done first by relaxing the assumption of constant carrying capacity of the Schaefer Gordon model and secondly, by making dynamic recruitment a function not only of spawning stock but also of critical environmental factors such as water temperature or nutrient availability, in an age structured bioeconomic model. Because there is no equilibrium biomass or sustainable yield in a fishery with fluctuating carrying capacity and/or recruitment, dynamic biomass and catch target and limit reference points (TRP and LRP, respectively) are calculated to aid fisheries management. In both approaches, a sine function is used to represent the long term fluctuating pattern in stock abundance. For specific cases appropriate periodic functions should be considered. Target biomass over time (TRPXt) is calculated proportional to the time varying carrying capacity. Fishing mortality is optimized (Fopt) to yield maximum net present values using alternative rates of discount, reflecting different prices of time. Fopt is then multiplied by time varying stock biomass to determine the corresponding optimum TAC over time.

Keywords: stock fluctuating fishery, climate change, limit and target reference points, optimizing fishing mortality.