Title: **Fishing Down the Food Chain: Modeling Trophic interactions in Exploited Marine Ecosystems**

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Abstract: There is increasing concern among fisheries scientists and managers over the ecosystem effects of fisheries exploitation. This concern has been motivated by several publications inferring that the structure of marine ecosystems has been dramatically altered by historical patterns of fishing. Among the most cited studies is the paper by Pauly who concludes that there has been a gradual transition in landings from long-lived, high trophic level, piscivorous bottom fish toward short-lived, low trophic level invertebrates and planktivorous pelagic fish. This effect has come to be known as fishing down the food chain and subsequent papers by Pauly and colleagues have elaborated on the original notion. There is reason to doubt the generality of Paulys results since the pattern of exploitation of a trophic system ought to be influenced by economic and institutional factors as well as biological factors. Hannesson has shown in a two-species model that the equilibrium ratio of exploitation depends upon price ratios as well as the institutional configuration. This paper develops a model of the fishing down effect in a dynamic four-species trophic model that is a generalization of Vernon Smiths open access model. We examine fishing down the food chain as a dynamic effect, and show that patterns depend not only on prices, costs, and biological parameters, but also on initial entry/exit levels and rates of adjustment of effort. We explore circumstances under which various patterns in the average trophic level of harvest may occur, and we compare indices of harvest with indices of system-wide biomass.