

Optimal management under fleet constraints: the case of Northeast Arctic cod

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Abstract

The objectives pursued by governments managing fisheries may include harvesting the fish stocks to maximize profits, to minimize the impact of harvesting on the marine ecosystem, or to secure jobs in the fishing industry. These objectives all depend on the composition of the fishing fleet as the various vessel types differ with respect to their operating costs, their environmental impacts, or how these boats provide employment opportunities on board or on shore. The Norwegian cod fishery consists of a fleet comprising coastal vessels, large longliners, and the fleet of trawlers and factory trawlers. These vessels score differently when it comes to meeting and reconciling these different objectives, and have therefore received mixed political support. In this paper, we develop an analytical model that shows the optimal TAC, biomass level, and long-run profits taking specifically into account fleet composition. This allows a regulator to adapt optimal management to the current fleet structure, but also analyze the bioeconomic consequences of a change in fleet structure (e.g. a ban on factory trawlers). We specifically take into account the occurrence of a fleet lock in, which means that the fishing fleet cannot be adjusted instantaneously, as several vessels cannot leave the fleet because of economic or political constraints. We apply the model to the case of Northeast Arctic cod, and econometrically estimate not only the cost and harvesting functions of the various vessel types, but also the parameters of the biological model as well as those of the demand function for cod.