

Acceptable regulation to reduce resource extraction with heterogeneous costs

Stefan Ambec, Alexis Garapin, Laurent Muller and Carine Sebi*

Gael, INRA-Université Pierre Mendès France, France

January 9, 2007

Worldwide, many natural resources such as fisheries are exploited under free-access. At least since Gordon (1954), it is well-known that the free-access extraction of a common-pool resource (CPR) leads to over-exploitation. To improve resource management, the fishing industry has been regulated with various instruments such as quotas, fees and subsidies. These regulatory instruments have diverse impacts on fishermen, depending on their technology and opportunity costs. Some may gain or lose more than others compared to the free-access extraction regime. The feasibility of a given regulation should take into account its acceptability by fishermen, driven by the fishermen's welfare.

We construct a model examining three regulatory instruments when fishermen differ with respect to their cost of fishing: non transferable individual fishing quotas, transferable individual fishing quotas and a fee/subsidy scheme (e.g. a fishing permit and vessel buy-back). All instruments must be acceptable in the sense that *all* fishermen must be better-off under the regulated extraction regime than under free-access. We provide necessary and sufficient conditions for the implementation of a targeted fishing effort. In our set up, a fee/subsidy scheme and transferable quotas are equivalent. They dominate non-transferable quotas because (i) they select the more efficient fishermen and (ii) they achieve a higher reduction of fishing effort.

In order to test our results, we then design an experiment based on this model, thereby contributing to the recent experimental approach to CPR extraction (Margreiter 2005, Ostrom 2006). Our study extends Walker *et al.* (2000) in introducing heterogeneity in extraction. We set the experiment with eight participants and two types of players (the players differ from their extraction costs and their opportunity costs). Each session consists of a *within-study*

*e-mail: carine.sebi@grenoble.inra.fr, tel: 04 56 52 85 98.

with four distinct treatments: the free access regime and the three above regulations (non transferable quotas, transferable quotas and a fee/subsidy scheme).

The experiment allows us to compare the performance of the three regulations using several criteria. We measure individual and social welfare (acceptability condition and inequality) by comparing profits in the four treatments. Furthermore, we assess the effort reduction (the achievement of the regulator's target and the convergence to it) and the selection of the less costly fishermen.

Key Words: common pool resource, experimental economics, regulation, heterogeneity.

JEL classification: Q22, Q28.

References

- [1] GORDON, H. S. (1954) "The economic theory of a common property resource: the fishery," *Journal of Political Economy* **62**, 124–142.
- [2] OSTROM, E. (2006) "The value-added of laboratory experiments for the study of institutions and common-pool resources," *Journal of Economic Behaviour and Organization* **2**, 149–163.
- [3] WALKER, J. M., R. GARDNER, A. HERR, AND E. OSTROM (2000) "Collective choice in the commons: experimental result on proposed allocation rules and votes," *The Economic Journal* **110**, 212–234.