Economics of Natural Resources
ECO 6143 (Winter 2010)
University of Ottawa
55 laurier E, 10th floor
Ottawa, Ontario, Canada K1N 6N5

Professor:
Louis Hotte
1-613-562-5800 ext. 1692
louis.hotte@uottawa.ca
http://aix1.uottawa.ca/~lhott3/

PROBLEM SET 2

1. Property regimes (Inspired by Cohen and Weitzman 1974.)

Pescado is a small town with 5000 fishers. Because they have little education, the fishers of Pescado cannot do anything else than fish to make a living. Next to town, there are only two lakes where fishers can catch fish, lake Tilapia and lake Loyola (named after a Jesuit missionary who lived there in a time when fish scarcity was not an issue).

The *total* output function on lake Tilapia is given by

$$y_T = 12x_T - 2x_T^2,$$

while that of lake Loyola is

$$y_L = 7x_L - \frac{1}{2}x_L^2,$$

where $x_T \times 10^3$ and $x_L \times 10^3$ denote the respective number of fishers on lakes Tilapia and Loyola, and y_i denote the total catch in thousand of pounds of fish. The price of one pound of fish is fixed and equal to 1.

(1) What will be the distribution of workers between the lakes in a regime of *open-access*? (Explain intuitively how you arrive at this distribution. An open-access regime is defined as a the limit of a free-access regime with an arbitrarily large number of fishers.)
(2) What will be the distribution of fishers between the lakes in a regime of exclusive ownership? (Suppose that each lake is exploited by a different owner who hires the fishers and takes the wage as given though the wage is endogenous to the model.)
(3) Assuming no transaction costs, which property regime is the most efficient? Is it the one preferred by workers? Explain.
(4) Suppose now that excluding access to a lake requires a fixed cost of 3000 per lake. Which property regime is efficient? Why?
(5) What would the equilibrium be if the fixed cost of exclusion were 5000 instead of 3000? Is exclusive ownership efficient?

2. Commons and anti-commons (Based on Dasgupta and Heal, 1979 and Buchanan and Yoon, 2000)

Assume that the total harvest function of a fishery is quadratic, i.e.

$$f(x) = ax - bx^2$$

where x denotes the total number of identical boats operating. There are n fishing firms, $i = 1, ..., n$, that can *freely* access the fishery at a cost of w per boat. Boats are the only input. Each harvest unit fetches a constant price p at the market.

(1) Determine the symmetrical Nash equilibrium number of boats per firm operating on the fishery. How does the total number of operating boats compare to the efficient level?

(2) Calculate the total rents that the fishery generates with n fishing firms and compare to the maximum that could be attained. Comment.

(3) Comment on what happens to the total number of boats and total rents when n increases, when $n = 1$ and when $n \to \infty$.

Assume now that there are m absolute rights holders to the same fishery, $j = 1, ..., m$. In order to send a boat on the fishery, a firm must ask permission to each one of those rights holders who will then demand a compensation. For each operating boat, let us say that rights holder j asks a price q_j, with $0 \leq q_j < \infty$. Hence, a firm must pay a total of $\sum_{j=1}^{m} q_j$ to operate a boat, on top of the standard cost w.

(4) Determine the total number of boats operating on the fishery *for given* $\sum_{j=1}^{m} q_j$.

For questions (5) to (7), assume that $n \to \infty$.

(5) Determine the symmetrical Nash equilibrium entry price q_j asked by each rights holder.

(6) How does the total number of operating boats compare to the efficient one and to the number found in (1)? Comment.

(7) What happens to rents when m increases, when $m = 1$ and when $m \to \infty$. Compare with (3) and comment.