AAE 343 Discussion Section 10

April 12th, 2019

I. Fishery Management

1. Sustained yield harvest levels maintain a fishery stock at a constant level over time: last week we identified S^{OA}, S^{MSY}, and S^{ESY}.

2. CAC fishery management may not be efficient due to over-capitalization (i.e., overly high costs).
   a. **Regulated open access**: harvest is limited each season, with the limit being set differently at each new stock level. In the long run, reach efficient sustained yield. But creates a "race to harvest", with fisherman boosting capacity (& thus costs) to catch before season closes
   b. **Limited entry**: cap number of boats. Fishermen respond by using bigger vessels, boosting crew size, or fishing more intensively (i.e. for longer periods of time before returning to shore).
   c. **Gear restrictions**: ban the use of certain technologies. Fishermen respond by sending out more boats that satisfy technology restrictions, or innovating to new productive techs.

3. Limited entry also suffers from overfishing, whereas regulated open access restricts the total size of the harvest via a **total allowable catch (TAC)**.

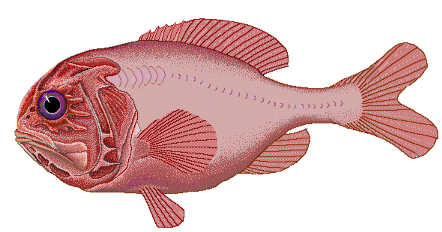
4. **Individual transferrable quotas (ITQs)** go one step further and allocate the TAC across participants in the fishery. Each ITQ yields an excludable fishing property right to its owner.

5. With ITQs, a regulator sets the TAC, and firms are incentivized to trade their ITQs until their **MECs have equalized**; as in the pollution cap-and-trade case from the first half of this course, equalized MECs minimizes total harvest costs for a given TAC.

6. In theory, properly set taxes and ITQs should both yield the efficient outcome. Yet ITQs are common in the real world, while taxes are not. Could be institutions (previously licensing/limited entry) or a regulatory capture story (ITQs may be attractive for consolidating market power)?

7. The (positive) price of an ITQ implies net benefit in the fishery:
   a. $Permit\ price\ = P - MEC_{Agg}(h^{ESY}) = MNB_{Agg}(h^{ESY})$

Problem 1 *Efficient fishery management with numbers* - Anne and Bill fish for orange roughy in New Zealand. Their marginal exaction costs are $MEC_{Anne} = 200(X_{Anne})$ and $MEC_{Bill} = 300(X_{Bill})$ where X is the quantity of harvest in tons. They sell orange roughy at a fresh market for $\$800/ton$ (assume demand is perfectly elastic). The total allowable catch is $TAC\ = 5\ tons$.

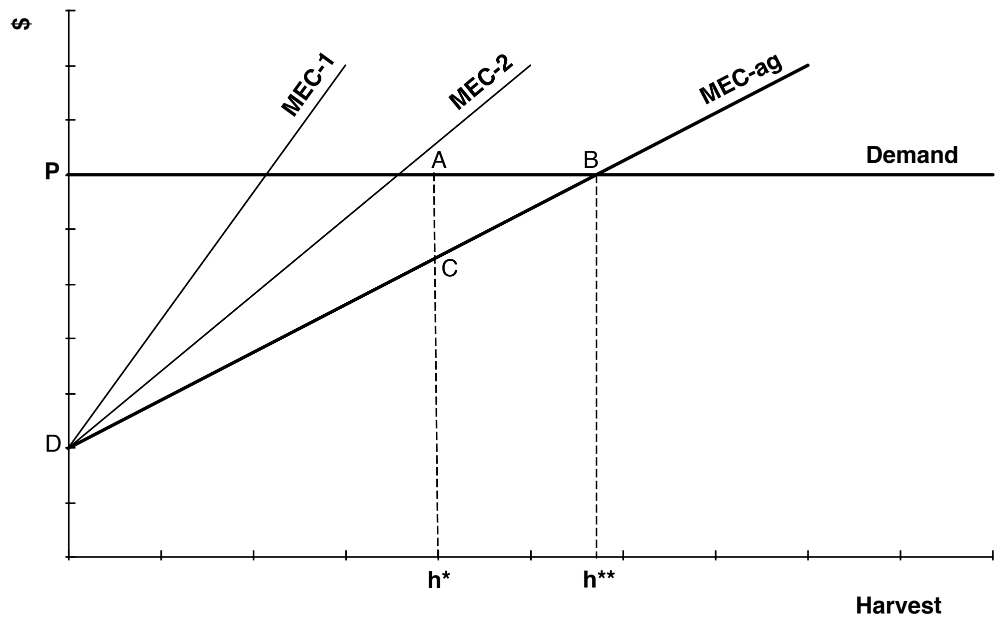


Orange Roughy (*Hoplostethus atlanticus*)

1. Bill claims there is no way that the TAC can be the efficient level because the efficient level is where $TAC\ = P - MEC_{Agg}$. Is he correct?

2. What is the least cost way to harvest the 5 $ton\ TAC$? What are the individual quantities and $MECs$ at the least cost solution?
3. If Anne and Bill respectively receive 3 and 2 permits for free from the government, what are Anne and Bill's profit?
4. What are their marginal net benefits for Anne and Bill in this case?

Problem 2 *Efficient fishery management without numbers* - Consider the illustration below, with two heterogeneous types participating in the fishery, and perfectly a horizontal demand curve for fish.



1. What is the total catch in the absence of government regulation?
2. Suppose the government sets TAC at h^*, and divides this amount between firms 1 and 2 using ITQs. What two conditions define the least cost allocation of the quotas?
3. Using the letters given in the diagram, what area represents the net benefit of the catch in the current period when the level of harvest is h^*?
4. Suppose h^* is sustainable, meaning this amount can be harvested year after year without changing the stock of the fishery. What is the net present value of the fishery, using a discount rate r and the area from part 3?
5. Suppose harvesting in the least cost way at h^* results in an industry aggregate MEC*. What is the market clearing price of a quota if they are traded?
6. Now suppose h^* is set as the TAC, but the catch is not allocated, so fishing boats compete for harvests up to h^*, and then the season is closed. Would the present value of the fishery still be the amount in part 4? Explain in a sentence or two.

Problem 3 *Trading ITQs* – The figure below concerns the allocation of ITQs for a small fishery. The total allowable catch for the year is equal to Q_{TAC}. The aggregate marginal extraction cost in the fishery is MEC_{AGG}. The diagram includes the MEC curves for two boats in the fishery, A and B. The amount of ITQs allocated to boat A is Q_A and the amount of ITQs allocated to boat B is Q_B. Answer the questions below.

1. **Top Hat Q1:** Does boat A buy or sell ITQs (or neither)?

2. **Top Hat Q2:** Using the lettering on the graph, state the price of an ITQ.

3. On the diagram use "H" to indicate boat B's harvest.

4. On the diagram, use shading to indicate the net benefit to boat B from the opportunity to trade ITQs.