

Outline

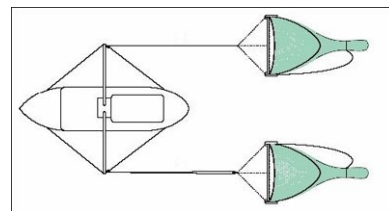
EE475: Natural Resources Economics Fishery Resource

11th March 2015
by
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- Introducing some types of fishing gear
- Biological aspect
- Static Efficient Sustainable Yield
- Effects from different property regimes

Types of Fishing gears

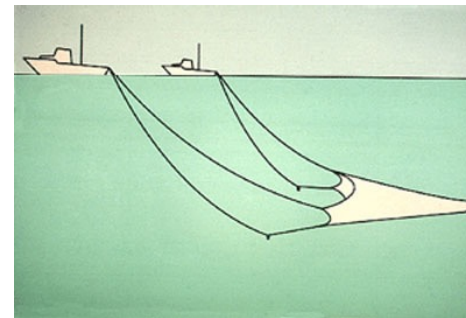
- Commercial Fishing Gears



Beam trawl (อวนลากคานถ่าง)

Types of Fishing Gears

- Commercial Fishing Gears



Pair trawl (อวนลากคู่)



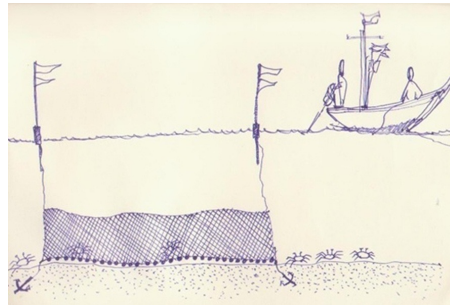
Push Net (อวนรุน)

Types of Fishing Gears

- Artisanal Fishing Gears



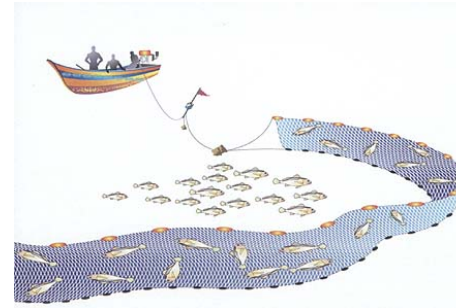
Dredge (คราด)



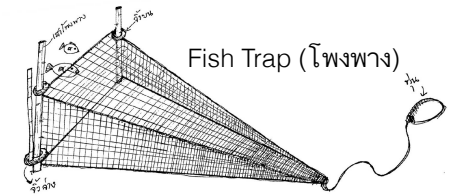
Trammel Net (อวนจม)

Types of Fishing Gears

- Artisanal Fishing Gears



Floating Seine, Gill Seine (อวนลอย)



Types of Fishing Gears

- Artisanal Fishing Gears



Crap Trap (ลอบตั๊กปู)

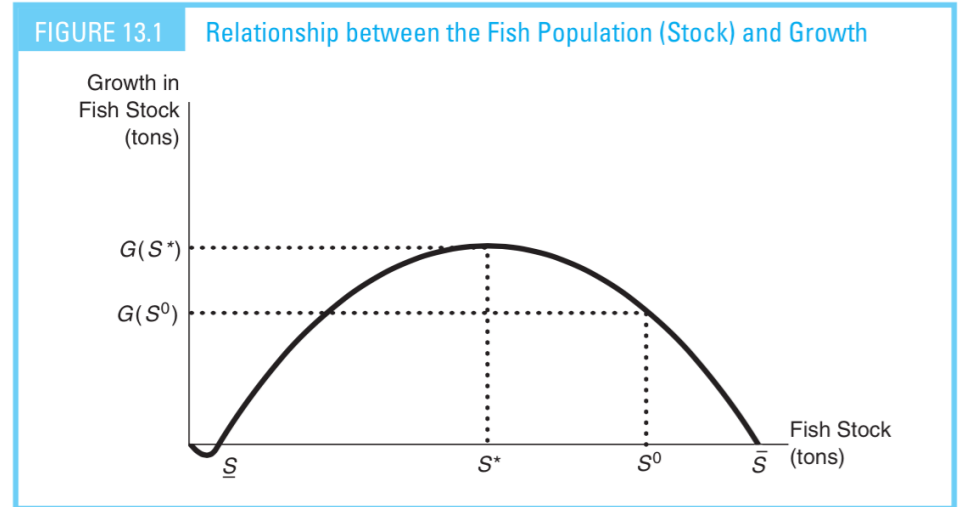


Introduction to Economics of Fishery

- Fishery is an 'Interactive Resources'
- Size of the resource stock (population) is determined jointly by biological characteristics as well as by actions taken by society.

Introduction to Economics of Fishery

- What is an efficient sustainable level of harvest?
- Whether efficiency is a sufficiently strong criterion to avoid extinction?
- Will efficient harvests always result in sustainable outcome?



Source: Tietenberg & Lewis (2012) p.322

Biological Aspect

- The Schaefer model: depicting relationship between “Growth in Fish Stock” and “Size of Fish Stock”
- The growth in fish stock increases from the fish stock S_- to S^* .
- Subsequently, the growth declines from S^* to $S\text{-bar}$.

Biological Aspect

- $S\text{ bar}$ is a natural equilibrium.
- It is natural equilibrium because it would persist in the absence of outside influences
- The reduction of the fish stock would be exactly offset by increase in the stock.

Biological Aspect

- S_{bar} is also a stable equilibrium.
 - When moving away from the equilibrium, the conditions around it would force the population to return to S_{bar} .
 - The fish stock is limited at S_{bar} could be because of the carrying capacity of its habitat.

Biological Aspect

- Sustainable Yield
 - A Catch Level = Growth Rate of the Population
- Maximum Sustainable Yield
 - Can you see where the Maximum Sustainable Yield is?

Biological Aspect

- S_- is the “minimum viable population”.
 - below this point, the growth in population is negative (deaths and out-migration exceed births and in-migration).
- S_- is an unstable equilibrium.
 - Can you see why?

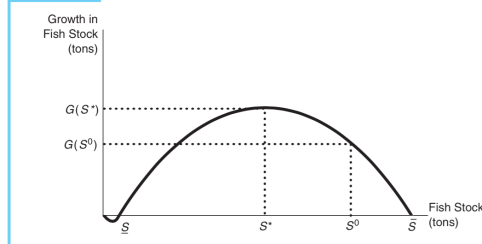
Biological Aspect

- Q: What happen to the fish stock if the catch is more than sustainable yield?
- Q: Can you see where the extinction could be?

Static Efficient Sustainable Yield

- Is the Maximum Sustainable Yield synonymous with efficiency?
- Recollection: What do we mean by “Efficiency”? What is it associated with?

FIGURE 13.1 Relationship between the Fish Population (Stock) and Growth



In the fish stock and growth graph on the left, horizontal axis is **Fish Stock**. The movement from smaller to bigger size of the stock is represented by the movement from left to right on the axis.

In the efficient sustainable yield graph (on the right), horizontal axis is not fish stock but **quantity of fishing efforts** (e.g. hours of fishing, vessel years). Therefore, the movement from smaller to bigger size of the fish stock is represented by the movement from right to left on the horizontal axis.

FIGURE 13.2 Efficient Sustainable Yield for a Fishery

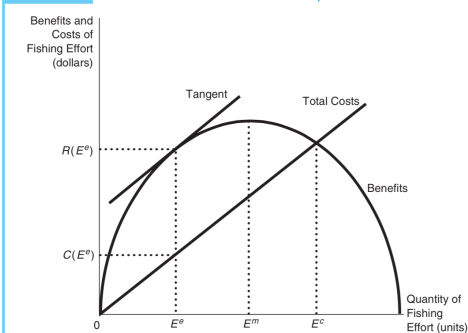
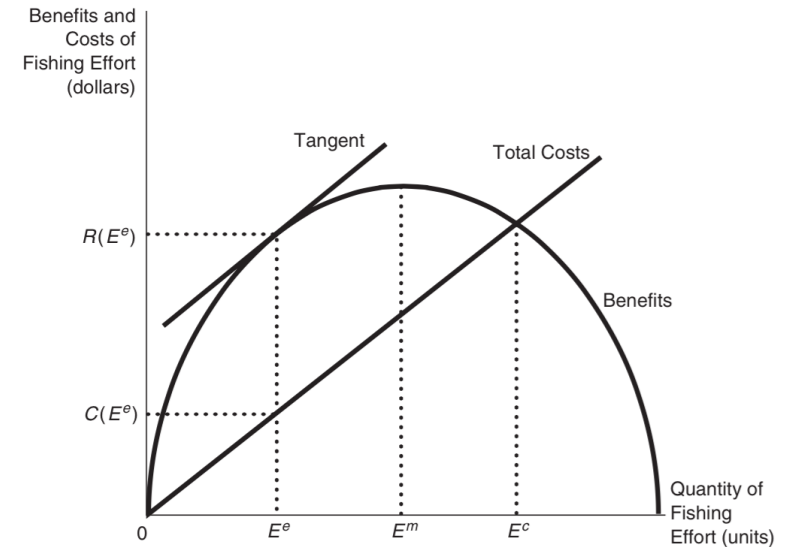


FIGURE 13.2 Efficient Sustainable Yield for a Fishery

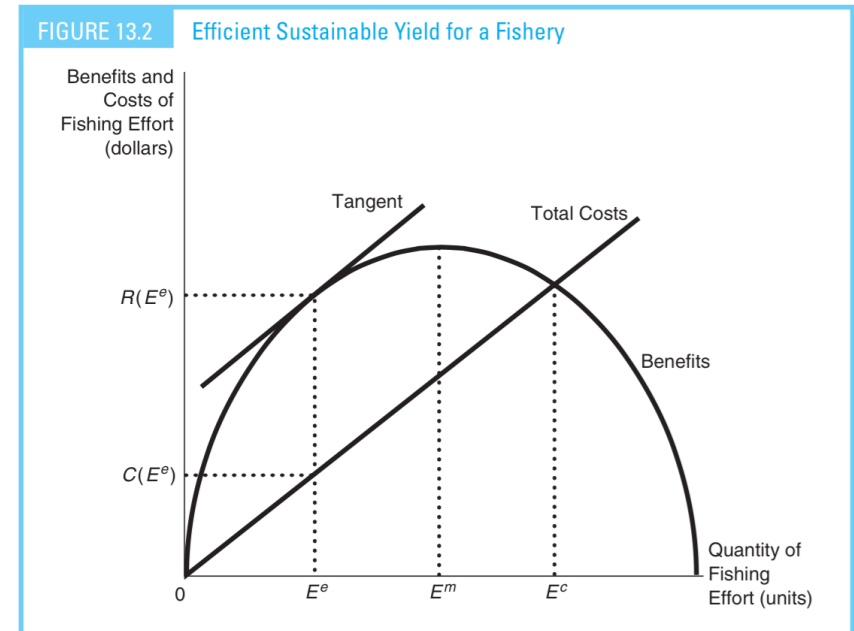


Static Efficient Sustainable Yield

- In any sustainable yield, annual catches, population, effort levels, and net benefits remain constant over time.
- The static efficient sustainable yield allocation maximises the constant annual net benefit.

Static Efficient Sustainable Yield

- Three assumptions
 - The price of fish is constant and does not depend on the amount sold; $\rightarrow$ shape of the revenue (benefit) function is dictated by the shape of the biological function.
 - The marginal cost of a unit of fishing effort is constant;
 - The amount of fish caught per unit of effort expended is proportional to the size of fish population (smaller population, the fewer fish caught per unit of effort).



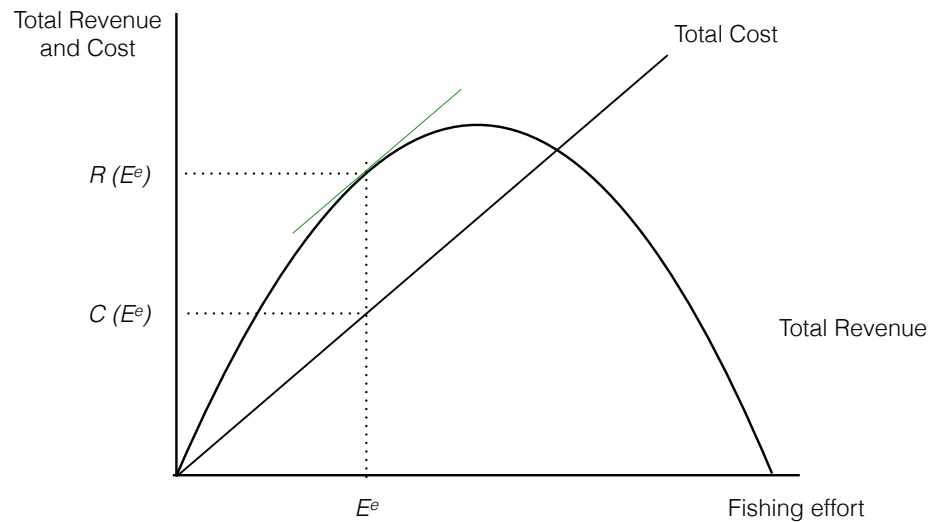
Static Efficient Sustainable Yield

- Beyond E^m , sustainable catch and revenue declines. (E^m corresponds to the maximum sustainable yield).
- E^e is the efficient level of effort. Can you see why?
- Back to the question: Is the Maximum Sustainable Yield synonymous with efficiency?

Static Efficient Sustainable Yield

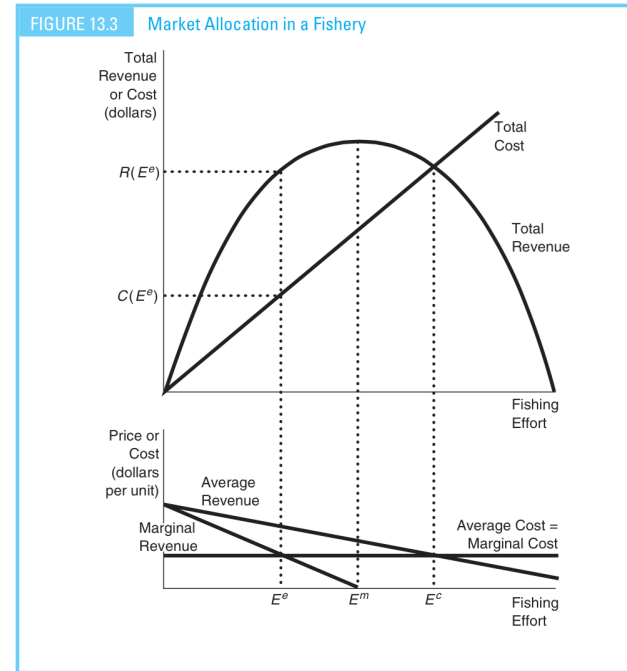
- What would happen to the graph if the following situations happen?
 - Technological change $\rightarrow$ lower marginal cost of fishing
 - Fishermen are forced to pay their workers at minimum wage $\rightarrow$ raising marginal cost of fishing
 - Marginal cost is zero.

Let's try some drawings



In the case of open-access property regime

- The open-access property rights in the case of fishery resource create two kinds of external cost
 - Contemporaneous external cost:
 - Too much effort is being expended to catch too few fish, and the cost is substantially higher than it would be in an efficient allocation
 - Intergenerational external cost
 - In the first period, overexploitation would result in higher catch. As a result the population is reduced, as well as the growth rate, causing future profits to be lower.



If **private property rights** over an area of the ocean is possible, which level would the fishing effort be?

In reality, open-access is more likely. Which level would the fishing effort be in the case of **open-access property regime**?

In the case of open-access property regime

- Is it always the case that open-access property rights would lead to a stock lower than (S^*) ?
- Does open-access fishing always pose the threat of species extinction? From the theory, what are the conditions determining the species extinction?