DiomFish Project

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DEPARTMENT of ECONOMICS

The Promise of Transferable Fishing Concessions On EU fisheries

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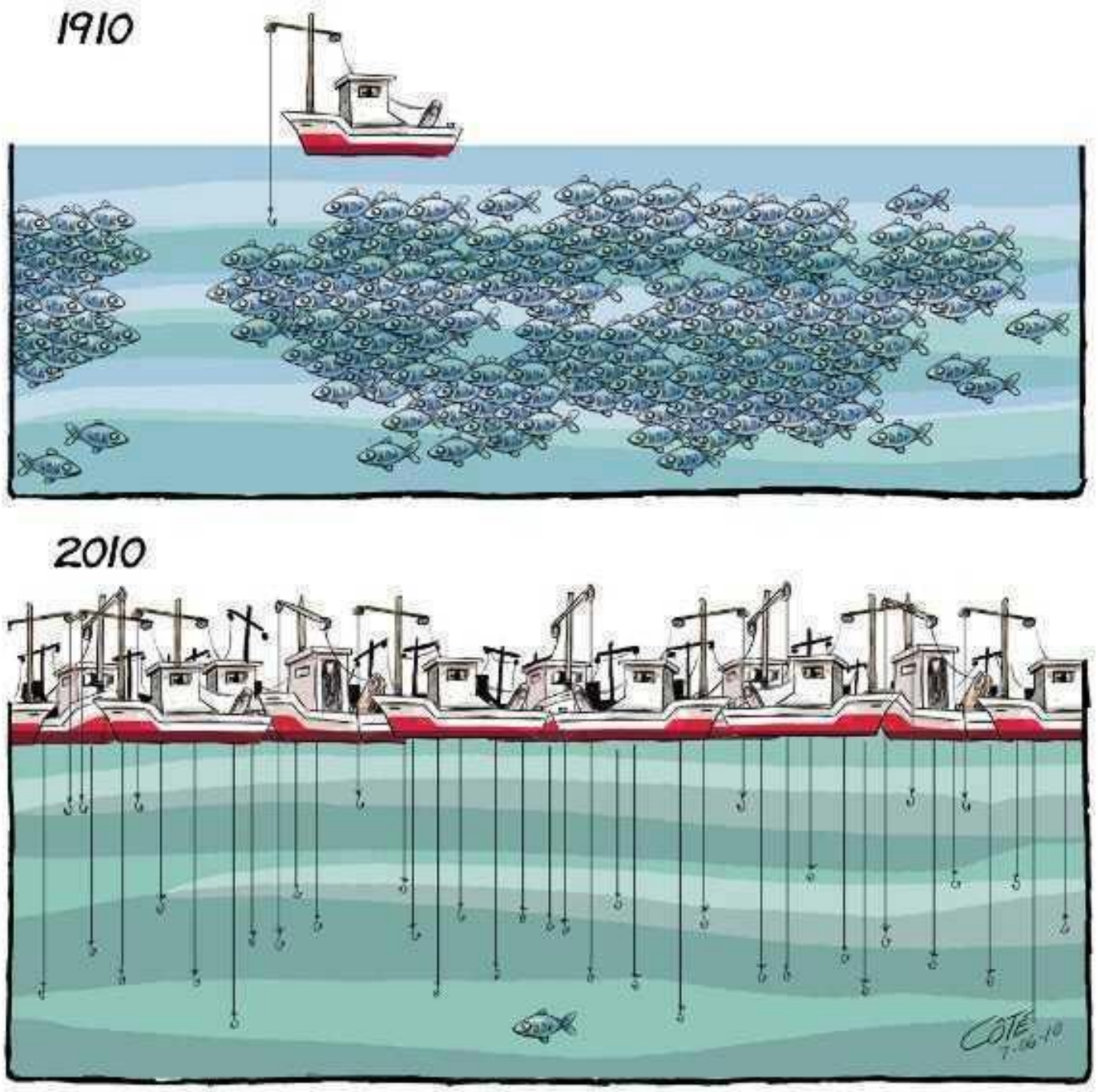
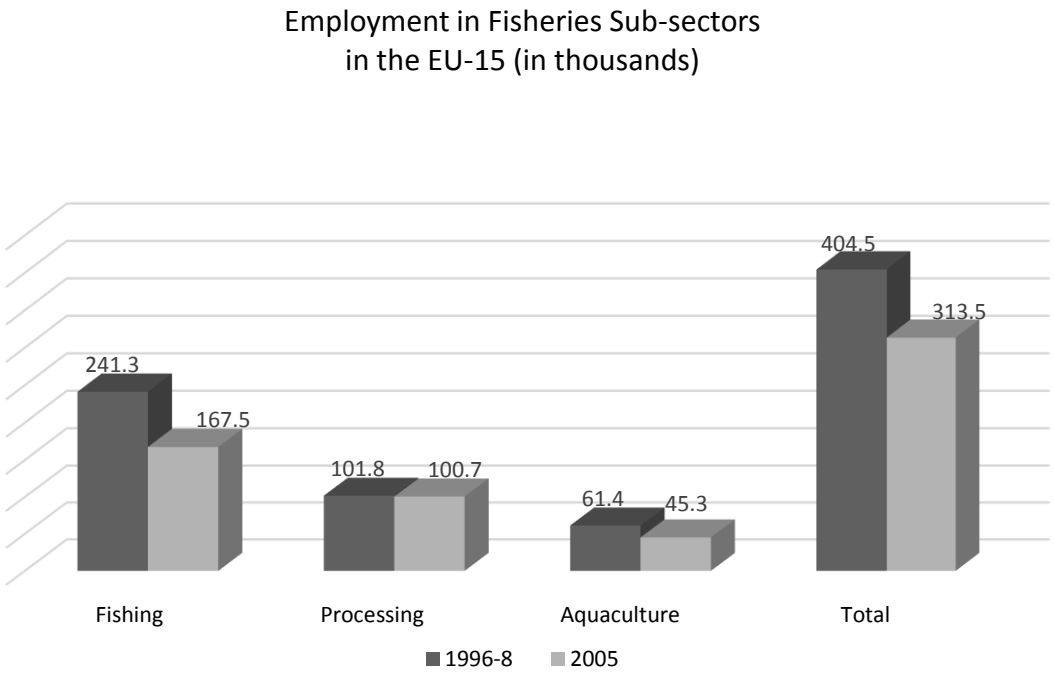
Main Problem



- CFP
- MSY
- TFCs
- small scale fishing communities

Employment in Fisheries



- Note that the decline in employment level was experienced intensely in the fish catching sector (30%).
- the EU small-scale fleet has declined from 87,894 in 2000, through 78,037 in 2005 to just over 70,000 in 2010, a decline of 20% in just 10 years.

European Small-Scale Fisheries

- 83% were smaller than 12m.

- The small-scale fleet represents about 10% of the total gross tonnage of the EU fishing fleet and about 35% of its engine power.

- The small-scale fleet varies between 72% and 97% of each MS's total fleet in terms of the number of vessels (Netherlands (37%) and Belgium (1%)).

- About two thirds of the small-scale fleet can be found in 5 countries: Greece (23%), Spain (11%), Portugal (11%), Italy (13%) and France (9%).

	<12m	>12m	Total
Number	70,087	13,969	84,056
1000kW	2,392	4,212	6,604
1000GT	177	1,603	1,780

Source: Community fleet register, 30.6.2010.

Main Result

- Two of the primary issues of the next CFP reform are MSY and TFCs.

- The interrelation between these two objectives should be well understood.

- Promoting small-scale fishermen is important for the sustainability of the social welfare and employment.

➢ Initial allocation of quotas does matter since reserving quotas for small-scale fishermen reduces the time needed to achieve MSY.

– Historical Catch: 54% of the fisheries
– Combination of the methods: 37% of the fisheries
– Equal Sharing: 6% of the fisheries
– Auctions: 3% of the fisheries (Lynham, 2014)

The Population Model

- Three cohorts of the fish population

  Juveniles, (age < 1)
  Young matures, (1 ≤ age < 2)
  Old matures, (2 ≤ age)

- Beverton-Holt type recruitment function. The numbers of recruits are,

$$X_{0,t} = R(X_{1,t}, X_{2,t}) = a(X_{1,t} + \beta X_{2,t})/[b + (X_{1,t} + \beta X_{2,t})]$$

$$w_0 < w_1 < w_2$$

$$p_0 = 0, \; p_1 < p_2$$

- Fishing activity occurs after spawning and before natural mortality.

- the population equilibrium (steady-state outcomes)

The Population Model

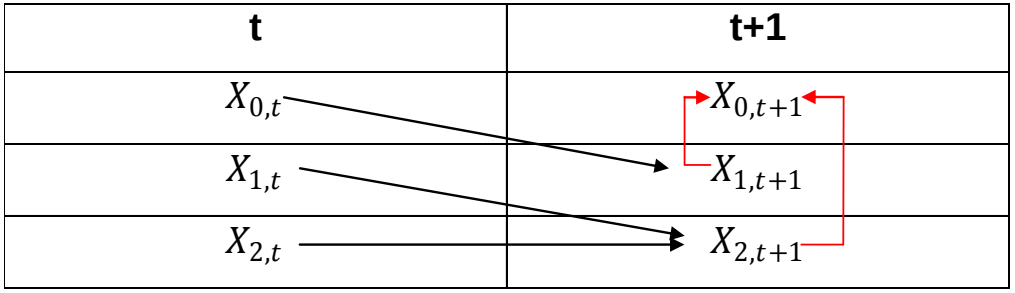
$$X_1 = s_0\, X_0$$

$$X_1 = s_0\, R(X_1, X_2)$$

$$X_2 = s_1\,(1 - f_1)\, X_1 + s_2\,(1 - f_2)\, X_2$$

f_1, s_1 and f_2, s_2 are the fishing mortality rate and the fixed natural survival rate of the young mature and old mature fish, respectively. Black arrows show the ageing structure from t to t+1 and red arrows show the recruitment structure of the fish population.

Table 1 Life cycle scheme of an age-structured fish population



Fishermen

- Fishing technologies of fishermen are denoted as $j_i \in [0,1]$.
- Catch composition: $100j_i$ percent old mature
  $100(1 - j_i)$ percent young mature.
- Fishermen: fishing selectivities and harvest capacities

- Small-scale fishermen (coastal fisheries),
- Large-scale fishermen (off-shore fisheries, trawlers)

$j_i > j_k$, $c_k > c_i$, $MC_i > MC_k$ for all $i \in S$ and $k \in L$

$R_S = \sum_{i \in S} \alpha_{i,0} = \sum_{i \in S} \alpha_{i,t} \in (0,1)$

One Period Problem

- $B_t = w_0 R(X_{1,t}, X_{2,t}) + w_1 X_{1,t} + w_2 X_{2,t}$

  Without fishing: $B^*_{t+1} = w_0 R(X^*_{1,t+1}, X^*_{2,t+1}) + w_1 X^*_{1,t+1} + w_2 X^*_{2,t+1}$

  With fishing: $B_{t+1} = w_0 R(X_{1,t+1}, X_{2,t+1}) + w_1 X_{1,t+1} + w_2 X_{2,t+1}$

- Total Biomass Change: $\rho^* = B^*_{t+1} - B_t$ and $\rho = B_{t+1} - B_t$

- One year net impact of fishing:

$$\rho^* - \rho = w_0 \left[R(X^*_{1,t+1}, X^*_{2,t+1}) - R(X_{1,t+1}, X_{2,t+1}) \right] + w_2 (s_1 f_{1,t} X_{1,t} + s_2 f_{2,t} X_{2,t})$$

Result 1: $R_S = \sum_{i \in S} \alpha_{i,0} \uparrow \Rightarrow \rho^* - \rho \downarrow$

Maximum Sustainable Yield

- The harvest function is,

$$Y = f_1 w_1 X_1 + f_2 w_2 X_2$$

The constraints for the maximization problem are,

$$X_1 = s_0 R(X_1, X_2)$$

$$X_2 = s_1 (1 - f_1) X_1 + s_2 (1 - f_2) X_2$$

- The Lagrange function and first order necessary conditions are as below:

$$L = f_1 w_1 X_1 + f_2 w_2 X_2 - \varphi [X_1 - s_0 R(X_1, X_2)] - \mu [X_2 - s_1 (1 - f_1) X_1 + s_2 (1 - f_2) X_2]$$

Table 3 Fishing mortality rates at MSY

	$\partial_L/\partial_{f_1}$	$\partial_L/\partial_{f_2}$	f_1	f_2
1) $\mu = w_1/s_1 < w_2/s_2$	$= 0$	> 0	$0 < f_1 < 1$	$= 1$
2) $w_1/s_1 < \mu < w_2/s_2$	< 0	> 0	$= 0$	$= 1$
3) $w_1/s_1 < \mu = w_2/s_2$	< 0	$= 0$	$= 0$	$0 < f_2 < 1$

MSY

- $X_1^{MSY} = s_0 a - \frac{b}{1+\beta\left(1-f_1^{MSY}\right)}$, $X_2^{MSY} = s_1\left(1 - f_1^{MSY}\right)X_1^{MSY}$

$$X_0^{MSY} = R\left(X_1^{MSY}, X_2^{MSY}\right)$$

- $B_{MSY} = w_0 X_0^{MSY} + w_1 X_1^{MSY} + w_2 X_2^{MSY}$

- The initial population is at a biomass level less than B_{MSY} at time t, and at B_{MSY} at time t*.

- t*-t=? On the path of stationary actions in which fishing mortality rates are time independent

- **Result 2:** Reserving nontransferable quotas for small-scale fishermen reduces the time needed to achieve MSY and hence sustainable fisheries.

Conclusion

- In the reform process of the CFP, the EU is seeking for an economically and socially viable, well-designed management system for EU fisheries.

- The EU promotes measures for achieving and sustaining MSY.

- EU tries to protect small-scale fishing communities in coastal regions

- In this study, we showed that the level of reserved quotas for small scale fishermen does matter since reserving more quotas for small-scale fishermen reduces the time needed to achieve MSY.


Thank you