An Empirical Investigation of Compliance and Enforcement Problems:

The Case of Mixed Trawl Fishery in Kattegat and Skagerrak

Cost and Benefits of Control Strategies (COBECOS)

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Outline

- **COBECOS**
- **The Danish Trawl fishery in Kattegat and Skagerrak**
- **Simulation results using COBECOS code v1 and v2:**
  - One species (Norway lobster)
    One type of enforcement (dock-side inspections)
  - Two species (Norway lobster and cod)
    Two types of enforcement (dock-side and bordings)
- **Lessons to be learned**

COBECOS

A cost-benefit analysis of control schemes for management strategies relevant for the Common Fisheries Policy

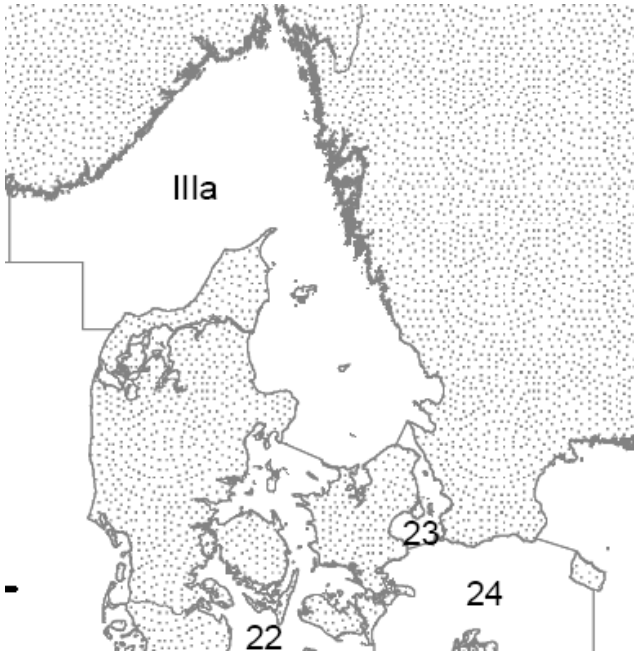
1. **an appropriate theory of fisheries enforcement,**

2. **empirical research involving intensive case studies and estimation of theoretical relationships,**

3. **computer modelling of fisheries enforcement (based on the theory and empirical estimations)**

Norway lobster trawl fishery in Kattegat and Skagerrak

- **Mixed trawl fishery**
- **Most important species:**
  - Norway lobster
  - Atlantic cod
  - Common sole
  - European plaice.



- **Norway lobster and Atlantic cod have a catch value more than two thirds of the total value of landings.**
- **The Danish Directorate of Fisheries risk-ranked these species to require a full enforcement effort.**

Actual Enforcement

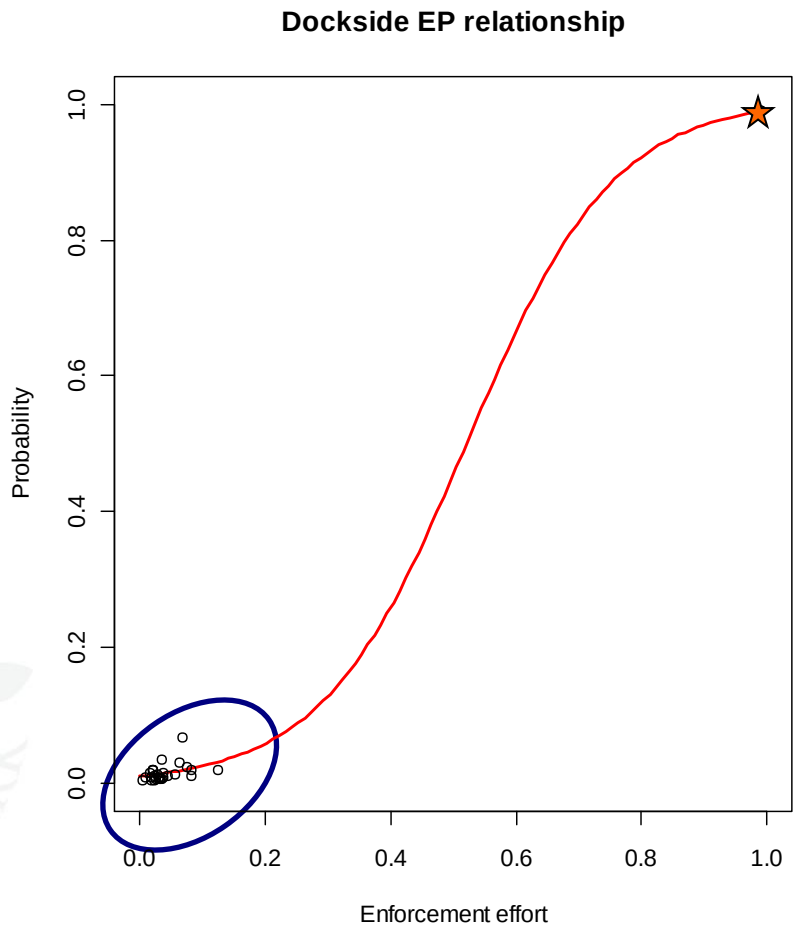
The enforcement fraction or normalised enforcement in the Danish fishing industry

	2003	2004	2005
Tot. number of demersal inspections	2 737	3 502	2 631
Tot. number of demersal landings	134 917	127 108	120 656
Enforcement ratio	0.020	0.028	0.022

The enforcement effort in the Kattegat and Skagerrak is slightly higher (2006) 0.04.

Referred to as enforcement or control intensity.

Estimations; Enforcement-Probability



Application of COBECOS software

Version 1:

- 1 species; Norway lobster
- 1 type of enforcement; dock-side inspections

Applied functional forms:

$$PrivateBFunc = Price * Harvest - PrivateFishingCost$$

$$-\begin{cases} 0 & if\ Harvest \leq TAC \\ Probability(Fine + Price) * (Harvest - TAC) & if\ Harvest > TAC \end{cases}$$

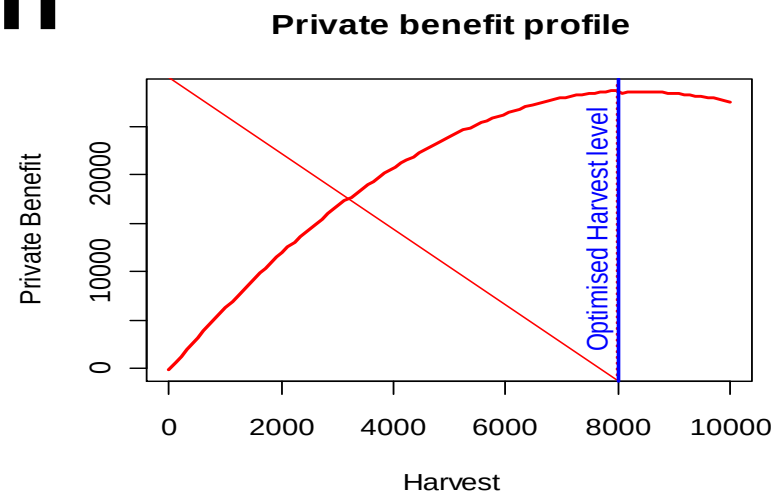
$$SocialBFunc = (Price - ShadowVB) * Harvest - PrivateFishingCost - EnforcementCost$$

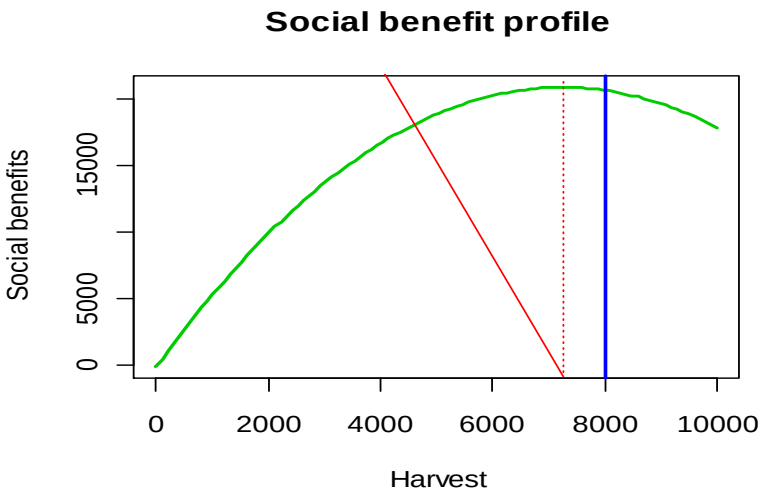
Results of simulation

Optimised model

Optimum	
Private benefit (Euro/vessel)	28 696
Social benefit /Euro/vessel)	20 679
Harvest (Kg/vessel)	8 000
Optimized control frequency	0.183

Baseline	
Private benefit (Euro/vessel)	28 744
Social benefit /Euro/vessel)	20 438
Harvest (Kg/vessel)	8 348
Compliance	95.65%
Control frequency	0.04

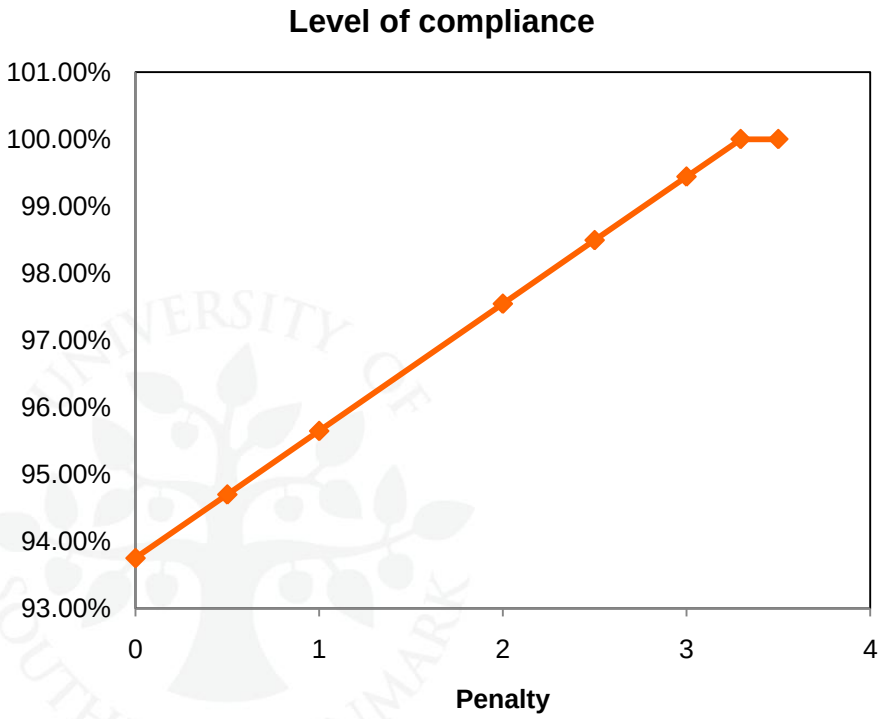


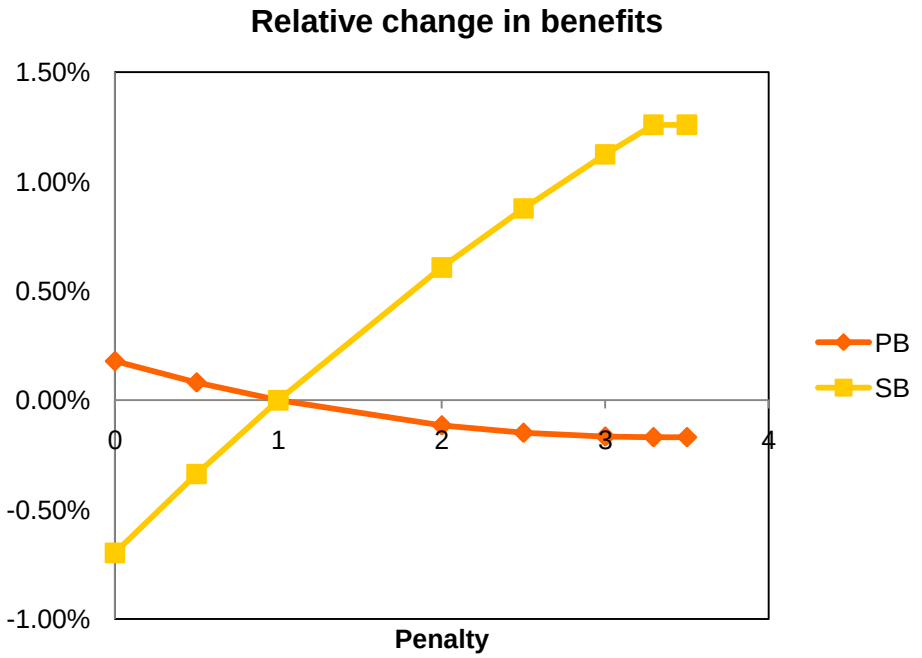


Results of simulation

Changing the fine

Enforcement effort = baseline=0.04

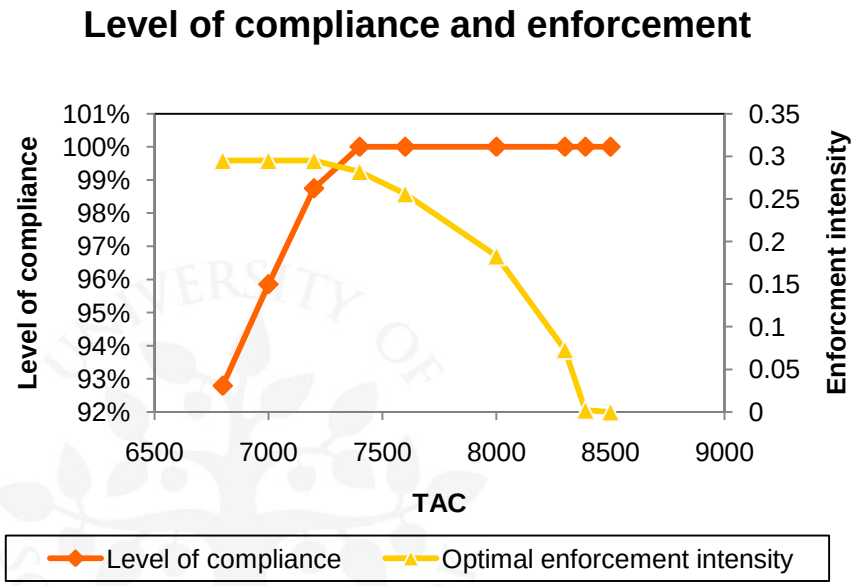


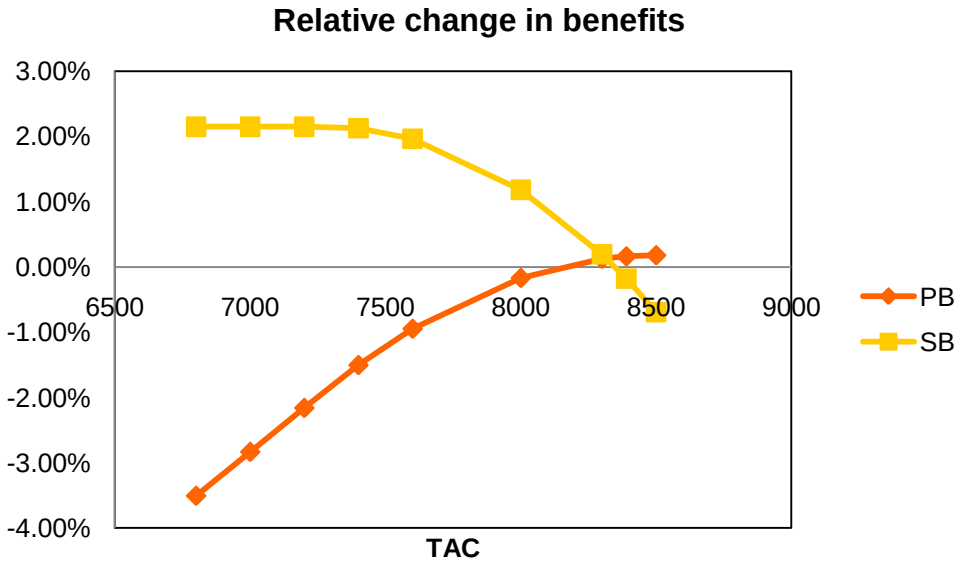


Results of simulation

Changing the TAC

Enforcement; optimal effort-levels



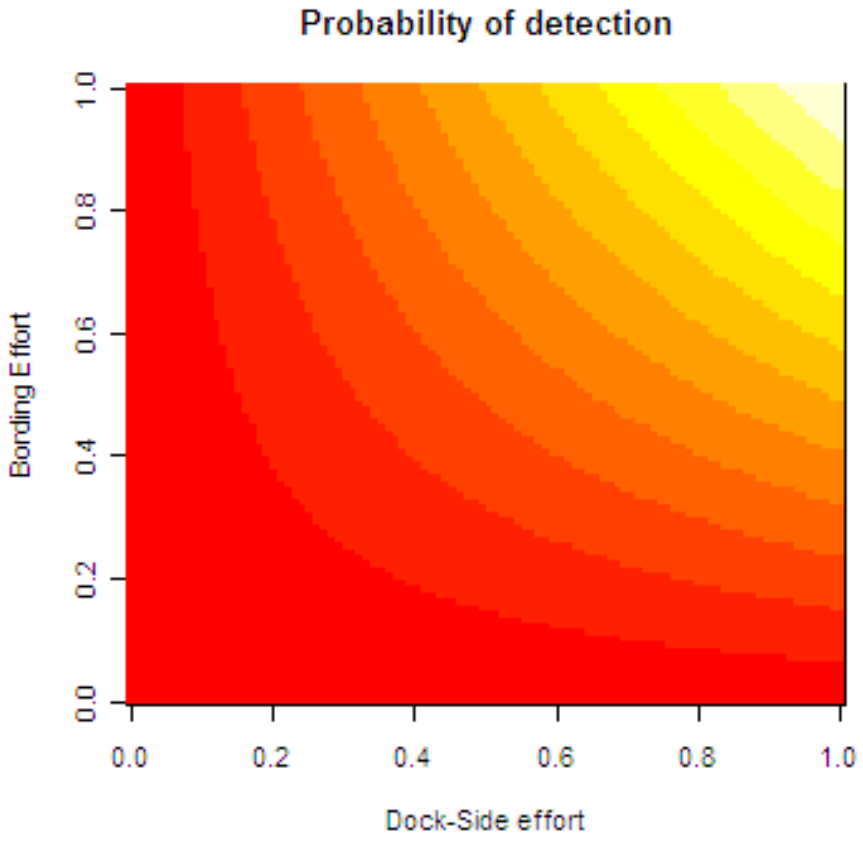


Application of COBECOS software

Version 2:

- **2 species; Norway lobster & Cod**
- **2 types of enforcement; dock-side & bording inspections**

Enforcement-probability function



Simulation (baseline)

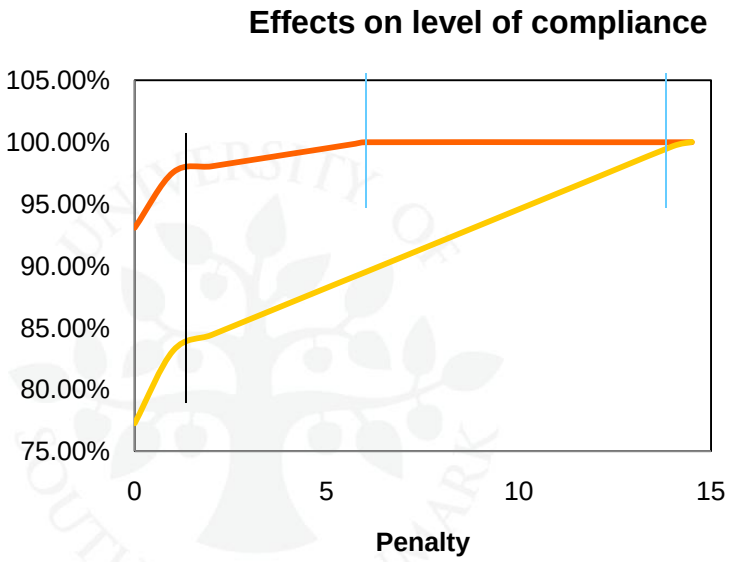
– **Estimated Results of actual enforcement**

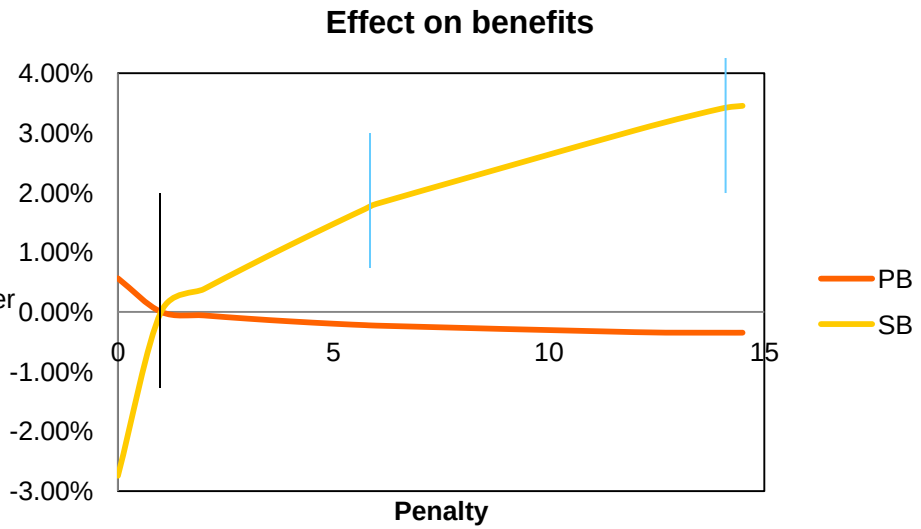
Name	Value
Private benefit (Euro/vessel)	34 279
Social benefit (Euro/vessel)	20 932
Norway Lobster harvest (Kg/vessel)	8 195
Norway lobster compliance	97.56%
Cod harvest (Kg/vessel)	3 506
Cod compliance	93.13%
Actual enforcement: Dock-side	0.039
Actual enforcement: Bordings	0.042

Results of simulation

Changing the fine/penalty

Enforcement intensities as in baseline case

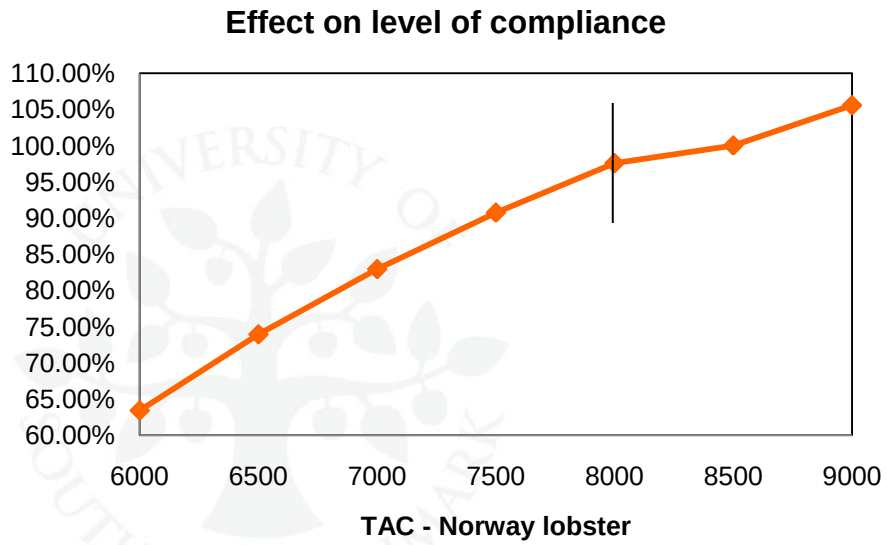


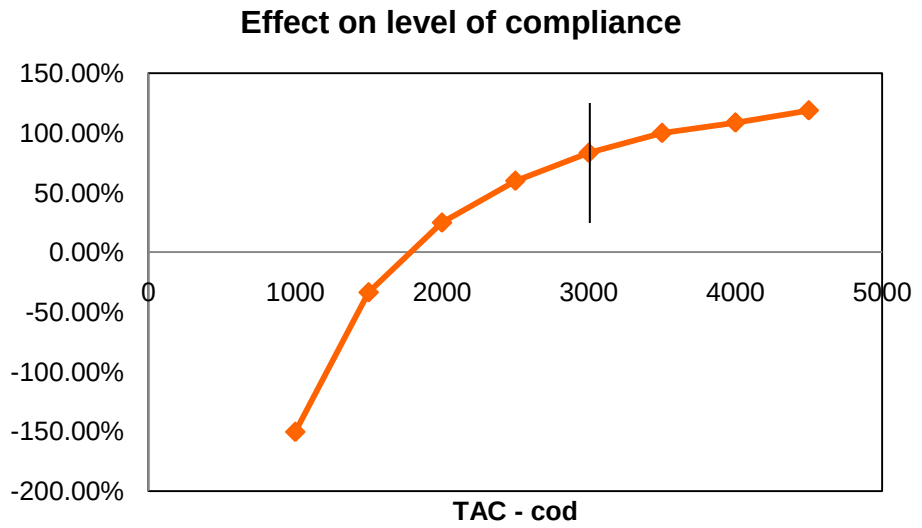


Results of simulation

Changing the TAC

Enforcement intensities as in baseline case





General Challenges

- The enforcement effort is targeted (Non-random).
- Only information about sanctioned violators.
- Extrapolation is necessary to define the enforcement probability function.
- Application of actual, and not perceived, probabilities.
- Limited availability of data.

Case Specific Challenges

- Defining what enforcement effort is and rescale it btw 0 and 1 for the COBECOS software.
- Cross sectional enforcement data (no time series).
- Extremely limited, basically non-existing enforcement cost information.

Lessons to be learned

- **Nothing gets better than the data underlying it!**
  - Encourage focus on data collection in the area in the future.

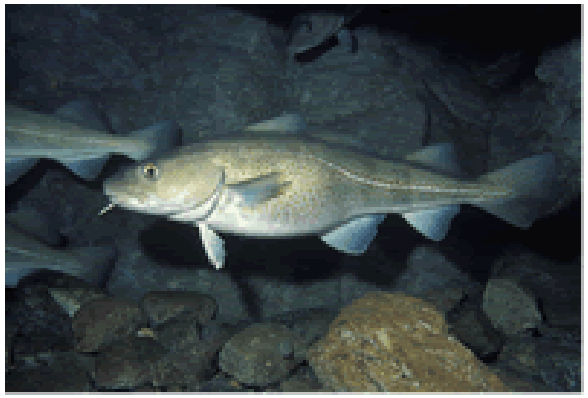
- **Confirms the theory:**
  - Higher fine reduces the need for enforcement.
  - A more binding regulation increases the enforcement need.
  - The shadow value of biomass only affects the benefits to society.

Lessons to be learned

- **The level of compliance**
  - is triggered by the
    size of the management measure relatively to the social optimum of the benefit profile.
  - Full compliance is optimal if the TAC is too high compared to social optimum.

Lessons to be learned

- **Similar results from v1 and v2:**
  - In the Norway lobster trawl fishery in Kattegat and Skagerrak the current level of enforcement is too low compared the social optimal solution.
  - Increments in the control frequency for both enforcement tools will increase the social benefits in the fishery and the level of compliance.



Thank you for your attention!