From trawl to pots: a bio-economic analysis of gear change

Claire Macher[1]

Catherine Talidec[2]

1. UMR AMURE, Université de Brest, France
2. IFREMER, Lorient, France

Macher and Talidec, IIFET 2008, Nha Trang, Vietnam, 22-25 July 2008

Introduction

High levels of joint productions (by-catches, discards) in fisheries using poor selective gears (active gears)

→high social costs

→ Make management more complicated (right based management is difficult to implement in a joint production context)

Selectivity improvements (mesh size increase, selective devices) has been widely used by fisheries policies as a solution to reduce joint productions and their social cost

However, their efficiency has remained limited

Selectivity improvements are difficult to detect

High incentives to circumvent selectivity measures in the framework of a non cooperative game

Individually fishermen are not incited to increase selectivity even when social benefits of selectivity is positive

Besides increasing fuel costs context enhances the need to reduce fuel consumption and to pay attention to less fuel consumer passive gears

→ Need to study alternative fishing techniques like pot instead of trawl:

more selective

selectivity is observable

Less fuel consumer

- Is a technical change valuable from an individual viewpoint?
- Is technical change to adopt gear with low joint productions levels profitable from a global viewpoint?

Plan of the presentation

1. Example of a fishery using an alternative fishing gear to target *Nephrops*: the *Nephrops* creel fishery of Loch Torridon (Scotland) and comparison with the *Nephrops* trawl fishery in the bay of Biscay (France)

   Joint productions, management and performances

2. Bio-economic impacts of a gear change in the *Nephrops* trawl fishery in the bay of Biscay
   Two kinds of scenarios
   - all trawlers adopt pot
   - A dynamic allocation of the fishing effort between trawling and potting as a function of the profitability by metier

   Analysis of effects of several economic incentives on profitability

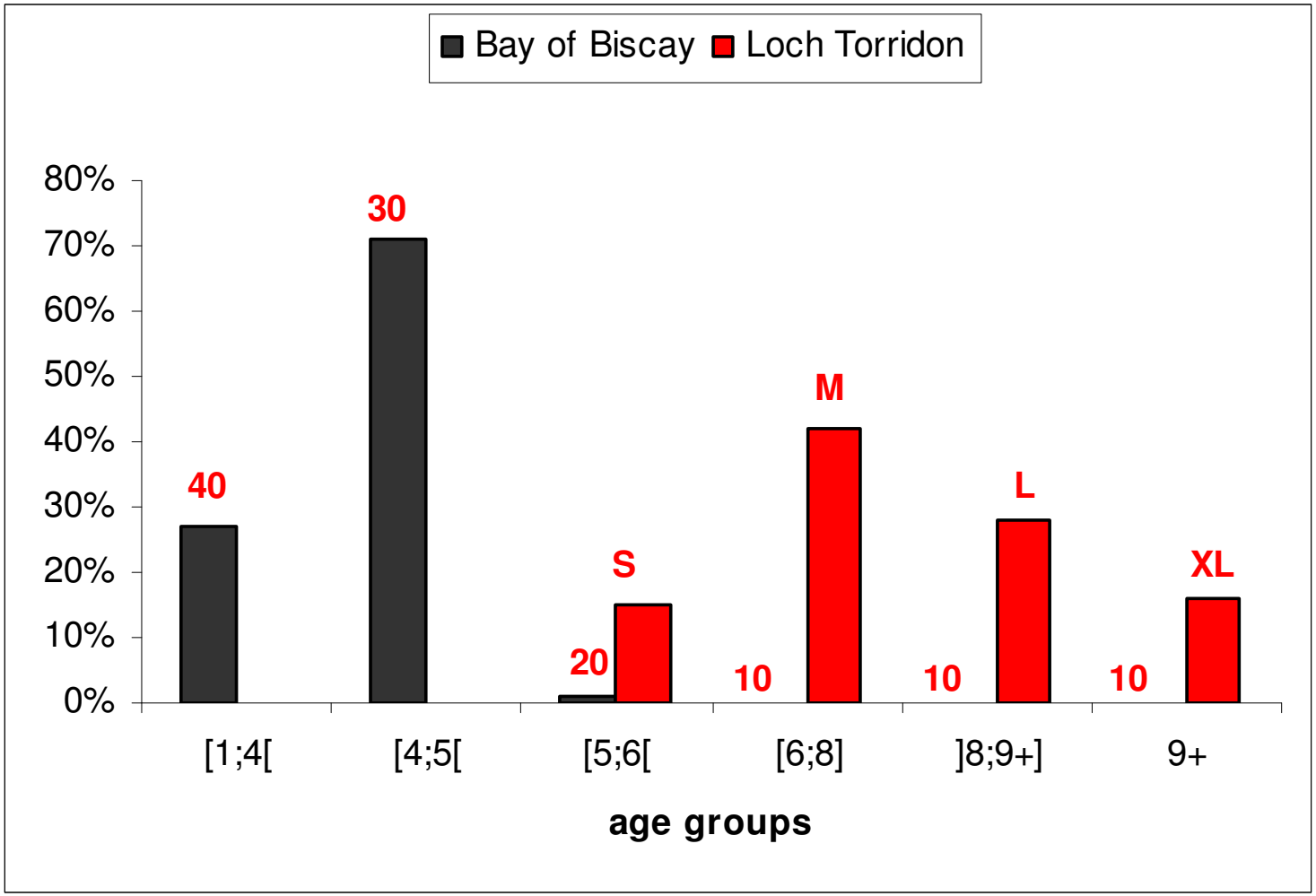
1. Comparison of the *Nephrops* creel fishery of Loch Torridon and the *Nephrops* trawl fishery in the Bay of Biscay

	Nephrops creel fishery Loch Torridon	*Nephrops* trawlers fishery bay of Biscay
Nb of vessels	13	250
Length (m)	10	15
Crew size	2	3
Activity	*Nephrops* targeted the whole year (+crab)	*Nephrops* trawling + 2 to 3 metiers per year
Management measures	Quota for the fishery: 100 to 150 t MLS (22 mm CL) Effort limitation (200 days at sea) Nb of pots (800/vessel/crew member), rigging restricted No *numerus clausus,* Licences (transferable) Fishing area closed to mobile gear since 2001 Eco labelling by the MSC in 2003	Quota: 3000 tonnes in 2004 (94% TAC VIIIab) MLS (27 mm CL) Minimum mesh size *Numerus clausus* Licences

2001-2003

Per vessel	*Nephrops* creel fishery Loch Torridon	*Nephrops* trawlers two members crew bay of Biscay (12 m)
Nephrops landings in tonnes	9.5	11.5
By-catches and discards	Low levels	High levels
Mortality rate of discards	Low	High (70%)
Mean price	13 euros/kg	9 euros/kg
Total gross return in keuros	124	148
Part of *Nephrops* in gross return	100%	60%
Nephrops gross return in euros/h	52	34

Nephrops CPUE kg/h: Loch Torridon 4.75-6.94 Bay of Biscay 4.5-13



Landings distribution per age groups and correspondence between grades and age groups

2001-2003

	For 100 euros Nephrops gross return		For 100 euros total gross return
	Nephrops creelers Loch Torridon	Nephrops trawlers South-Brittany	Nephrops trawlers South-Brittany
Total gross return in euros	100	167	100
Nephrops gross return in euros	100	100	60
Total shared costs in euros	8	34	21
Fuel costs in euros	4.6	18.9	11.3
Return to be shared in euros	92	133	79
Return to be shared in euros/h	48	45	45

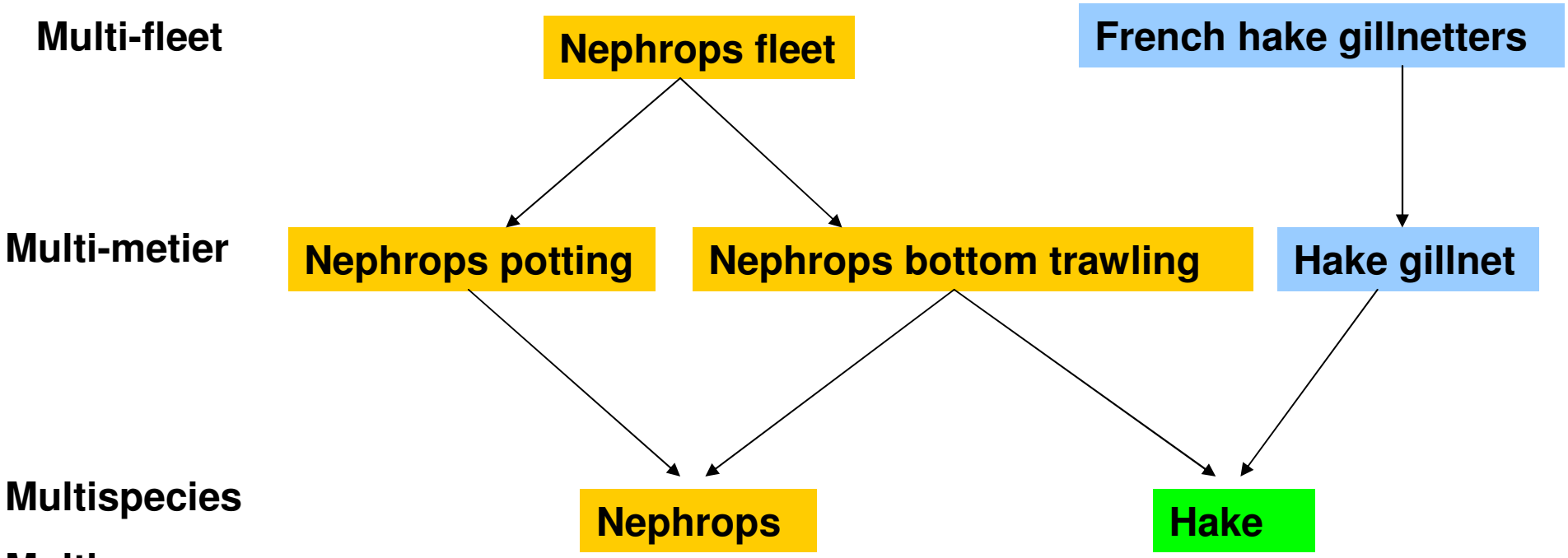
Nephrops pot might be both a profitable and a very selective gear when used in adequate regulation system

	Nephrops creelers Loch Torridon	Nephrops trawlers South-Brittany
Fuel consumption L/h	5.6	26.8
Fuel cost in 2001-2003	4.6%	11.30%
Fuel cost in 2007	8.5%	21.70%
Return to be shared in euros/h in 2007	46 euros/h	39 euros/h

Fuel cost increase favours alternative gear

2. Bio-economic impacts of a gear change in the *Nephrops* trawl fishery

Bio-economic model framework



Other assumptions:

Exogenous recruitment

Exogenous price per grade

Allocation of fishing effort between pot and trawl

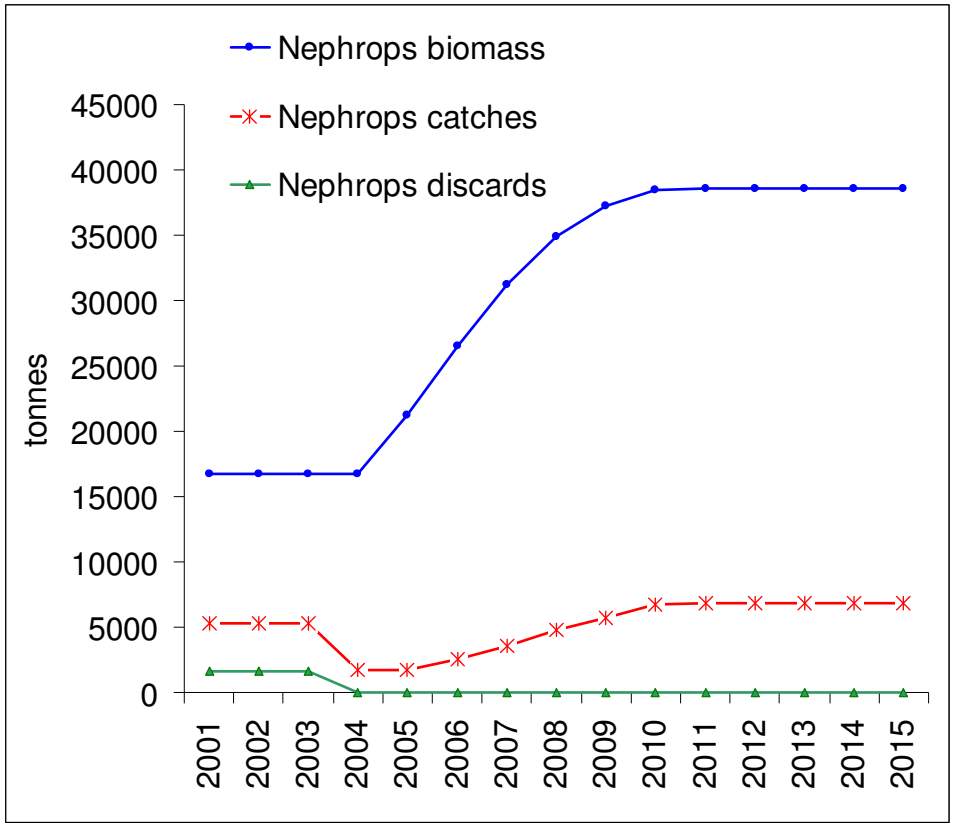
A. Exogenous. All the effort is allocated to pot

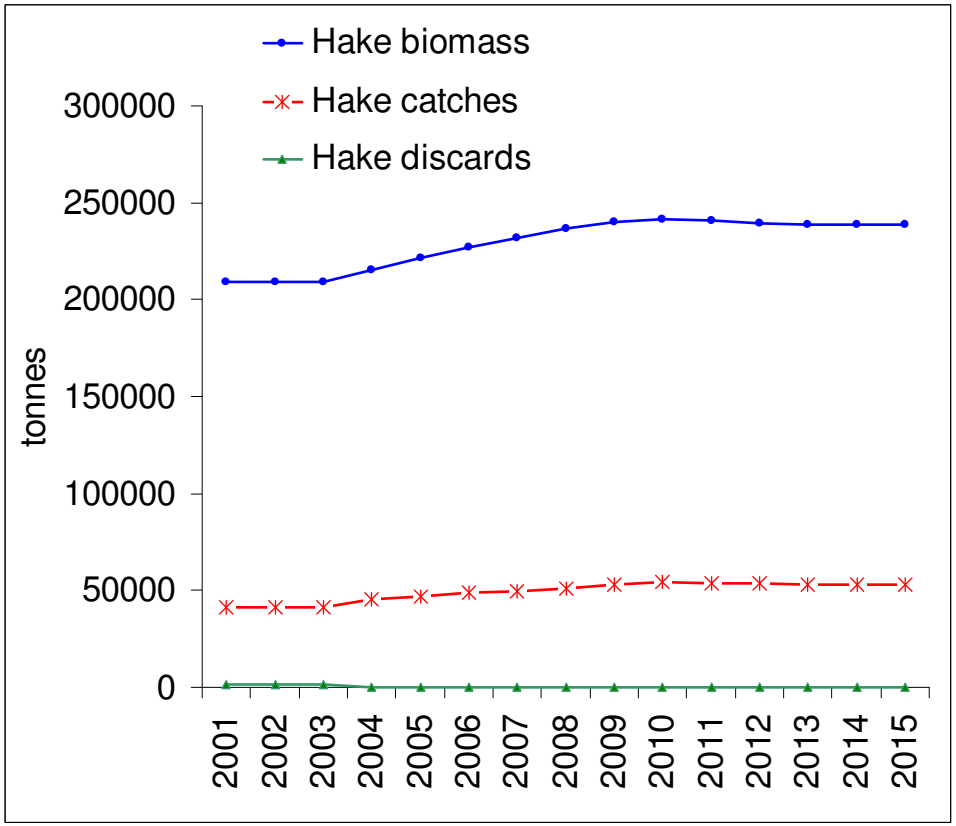
B. Dynamic: function of the difference of return to be shared by metier and of an α coefficient (gear change inertia)

Catchability in Loch Torridon= catchability in bay of Biscay
Sensitivity of the model to the following hypotheses is addressed :

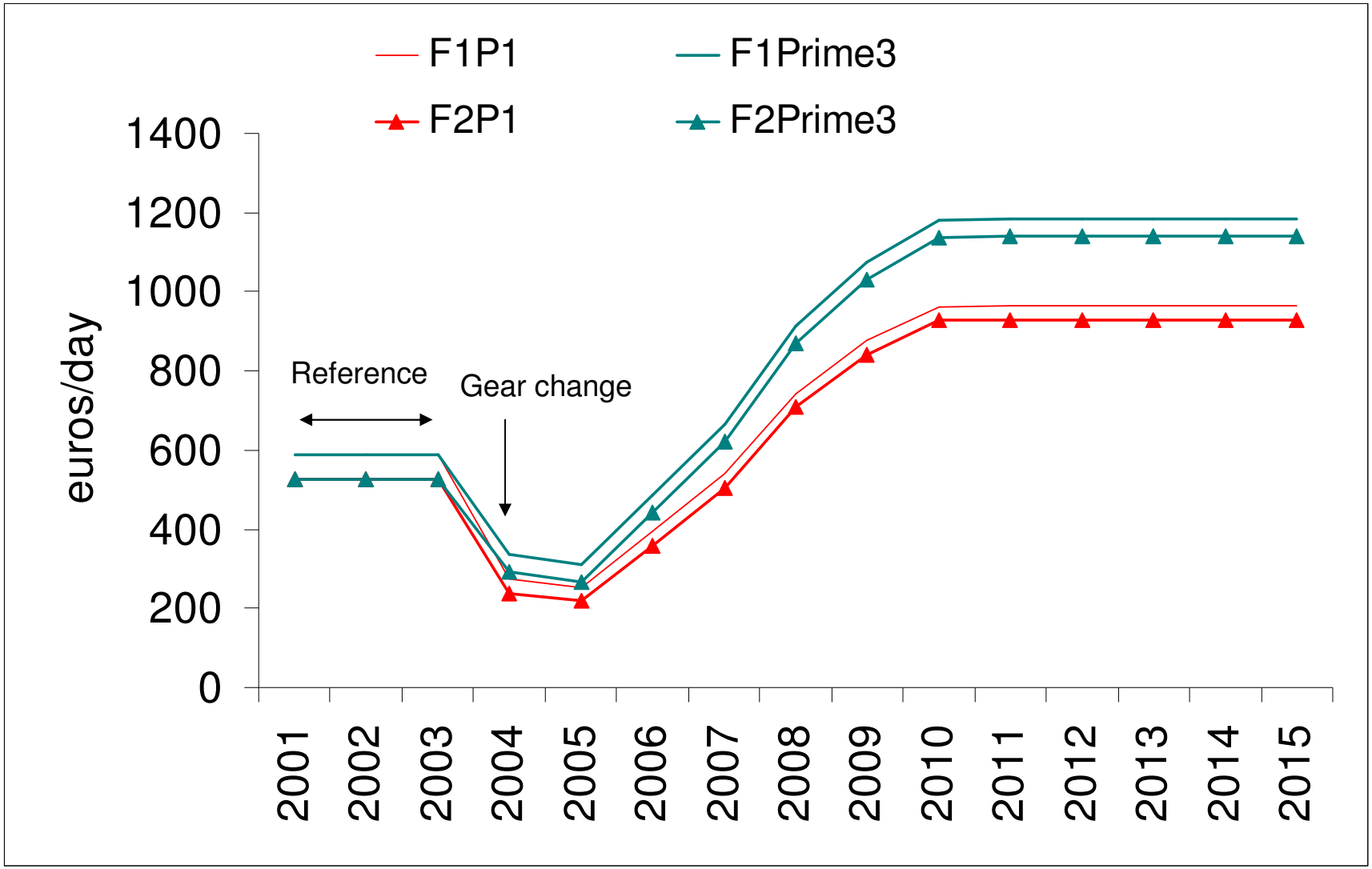
		Price model for *Nephrops* caught by pots	
		P1: same Nephrops price model for the two metiers	**Prime 3**: 3 euros/kg prime for Nephrops caught by pots compared to Nephrops caught by trawlers
Fuel price	**F1**: fuel price 2001-2003 0.2751 euros/L	F1P1	F1Prime3
	F2: fuel price 2007 : 0.4897 euros/L	F2P1	F2Prime3

A. Results of pot adoption by the whole Nephrops trawler fleet





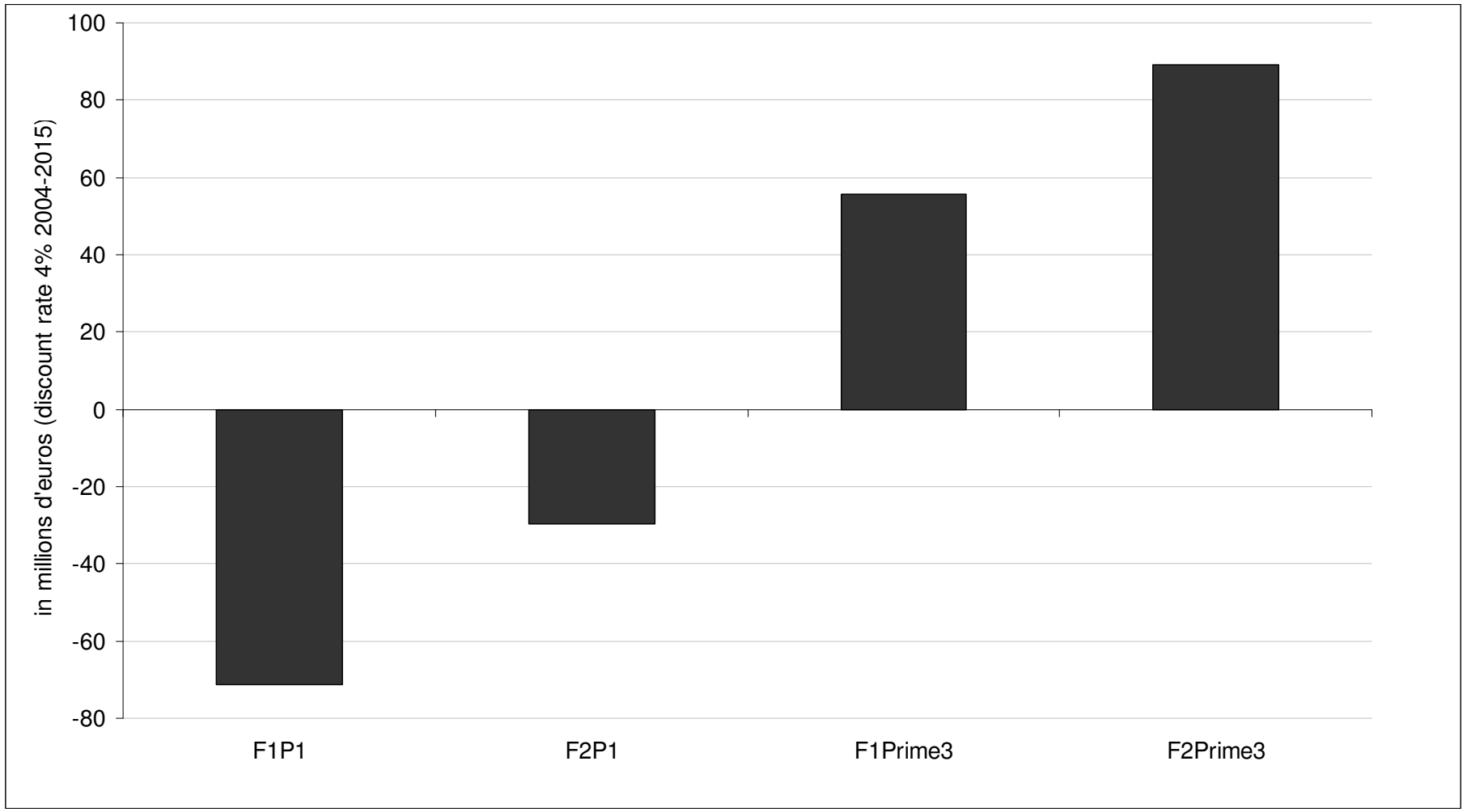
A. Results of pot adoption by the whole Nephrops trawler fleet



Evolution of the return to be shared / day for the Nephrops sub-fleet 2 crew members

Macher and Talidec, IIFET 2008, Nha Trang, Vietnam, 22-25 July 2008

A. Results of pot adoption by the whole Nephrops trawler fleet



Producer surplus variation (Nephrops producers and hake gillnetters), discount rate 4%, 2004-2015

Net benefit is positive when pot *Nephrops* obtain high prices

Macher and Talidec, IIFET 2008, Nha Trang, Vietnam, 22-25 July 2008

B. Results for the dynamic effort allocation model between metiers

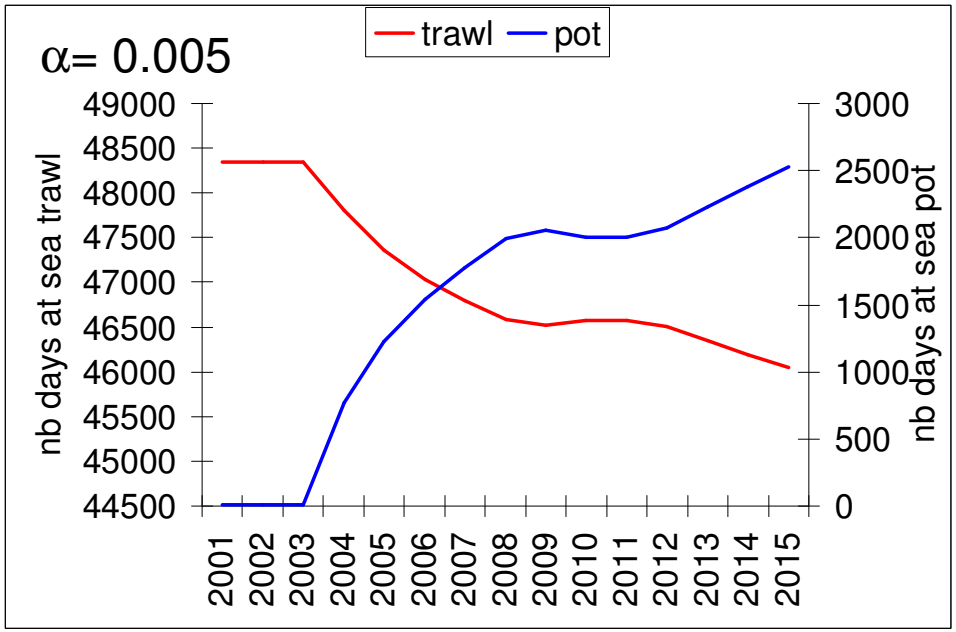
$$\Delta E_{pot} = \alpha.(\frac{RS_{pot}}{E_{pot}}(t) - \frac{RS_{trawl}}{E_{trawl}}(t))$$

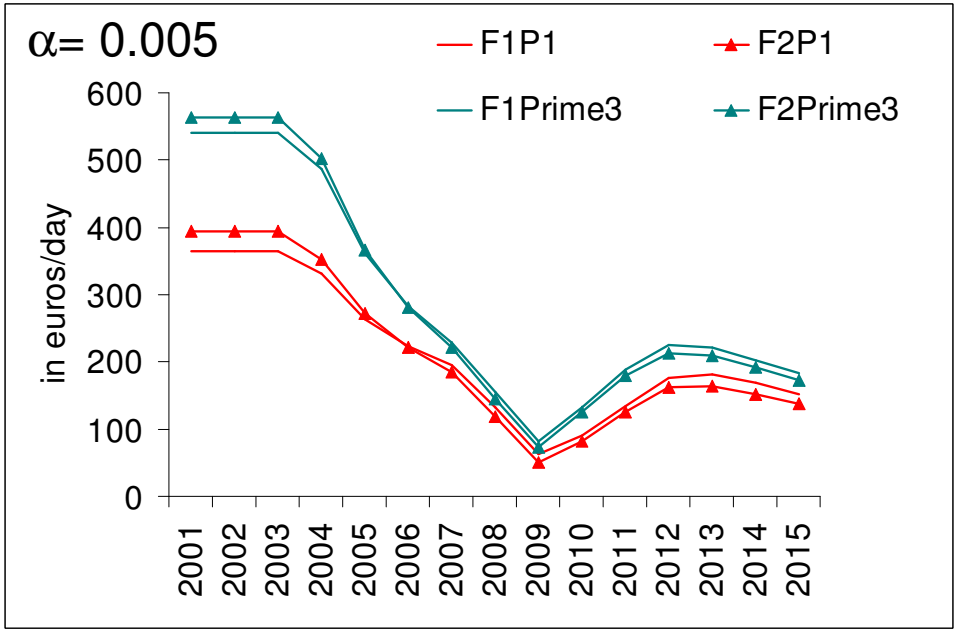
Simplified extrapolative model

Oscillations in effort allocation due to sequential gear and recovery speed

Oscillations are more or less important according to α

Difference of RS becomes negative for some sub-fleets → second gear change to trawling





Concluding remarks

Potting instead of trawling can be a profitable activity (individually and socially)

Its profitability compared to trawling mainly depends on fuel consumption, price and feasible CPUE

- Technical surveys to develop performing gears

- Need to identify area closed to mobile unselective gear

Competition for stock and space →Spatial incompatibility between these two metiers

- Setting up a Marine protected area dedicated to passive gears like *Nephrops* pot could promote emergence of alternative gear techniques and so decreases the social cost of *Nephrops* exploitation by bottom trawlers.

- Short term losses of the gear change and social cost of the status quo → question of financial support to gear change, could be legitimate in this case

- Spatial model and question of effort re-allocation to address impact of an area closed to trawl in the bay of biscay