Economics in Fisheries Management

LPWM2005 Fisheries Management

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Lecture 3. *The costs of overfishing* (PowerPoint)

The University of Queensland, 17 August 2012

Accessing Notes to slides in pdf

1. Go to left hand bar, click on the ‘Layers’ icon (third from top);
2. Activate the ‘Presentation notes’ box;
3. To read Note, put cursor over ‘speech’ icon when it appears in top left corner of the slide.

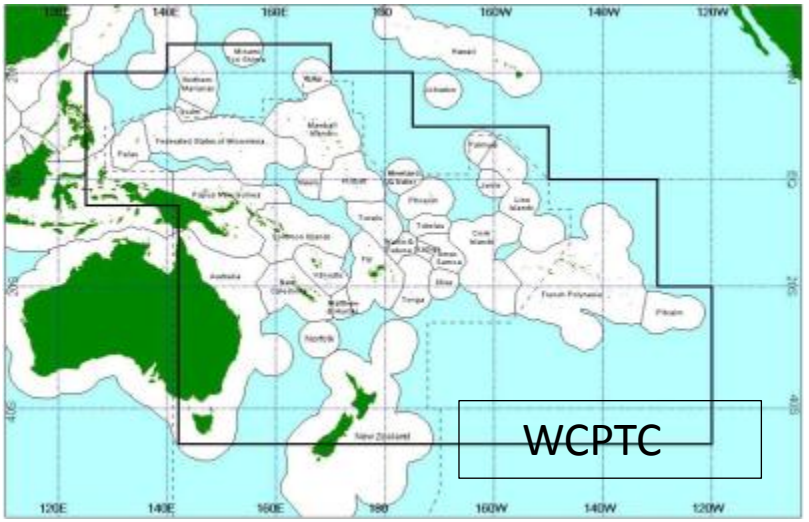
Two case studies

1. Overfishing in the WCPTF (Western and Central Pacific Tuna Fishery)

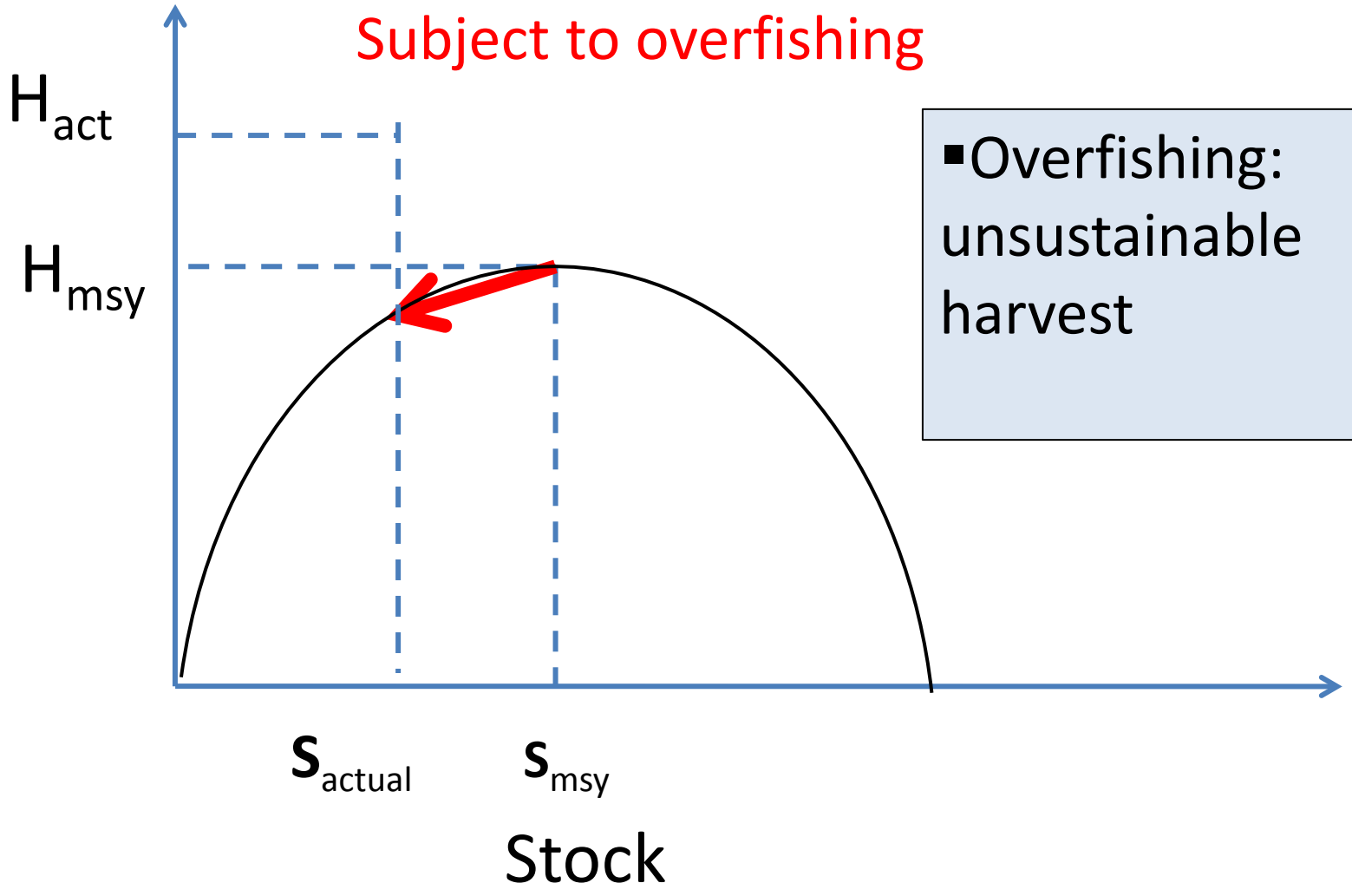
2. Overfishing in the ETBF (Eastern Tuna and Billfish Fishery of Australia)

Overfishing in the WCPTF

- Scientific Committee of WCPTC recommends limiting fishing effort on tuna
- Fishers and member countries reject recommendations

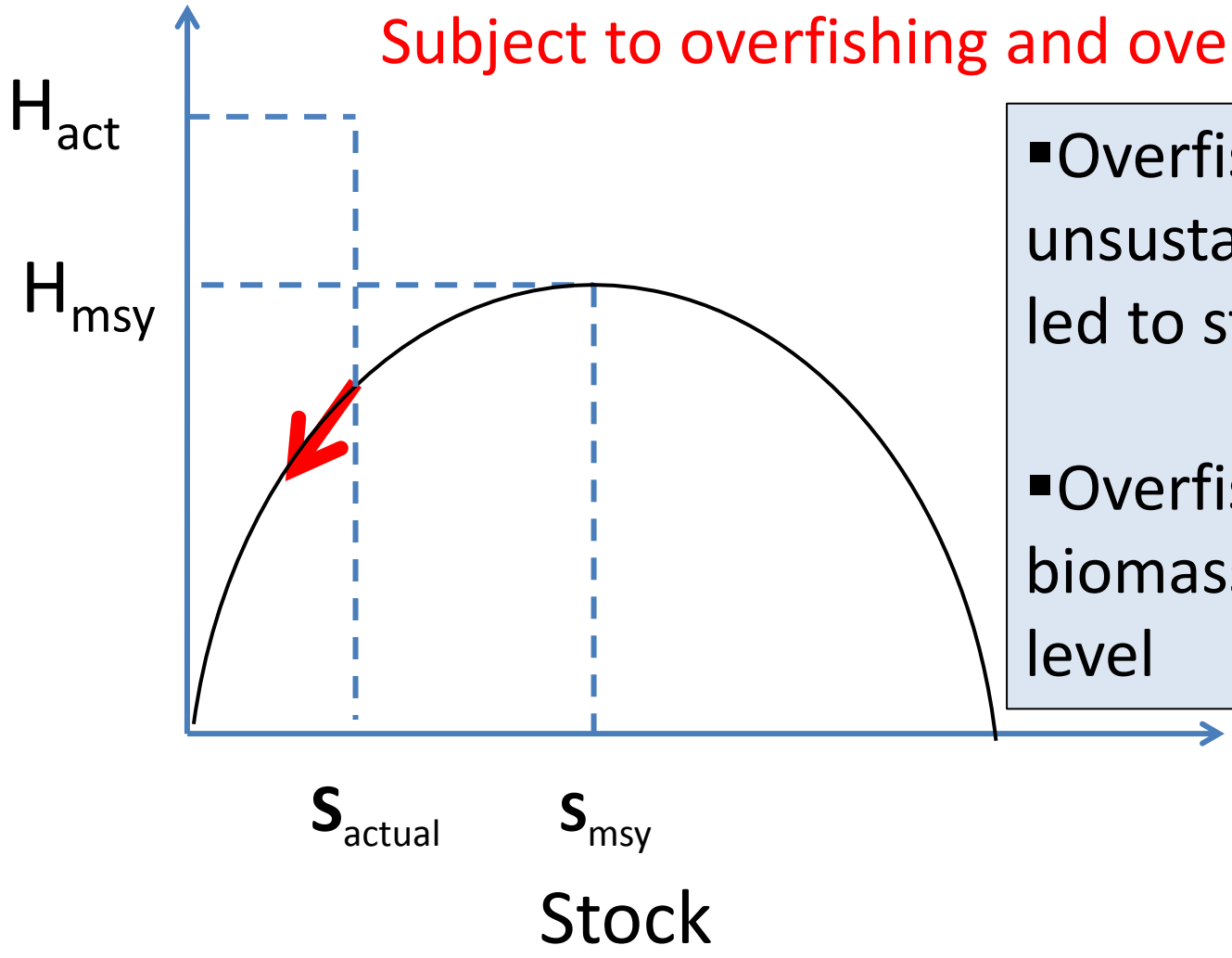


Status of stocks WCPTF: Yellowfin



- Overfishing: unsustainable harvest

Status of stocks WCPTF: Bigeye



- Overfishing: unsustainable and led to stock decline
- Overfished: biomass at low level

Research question: Tuna fishing in WCPTF

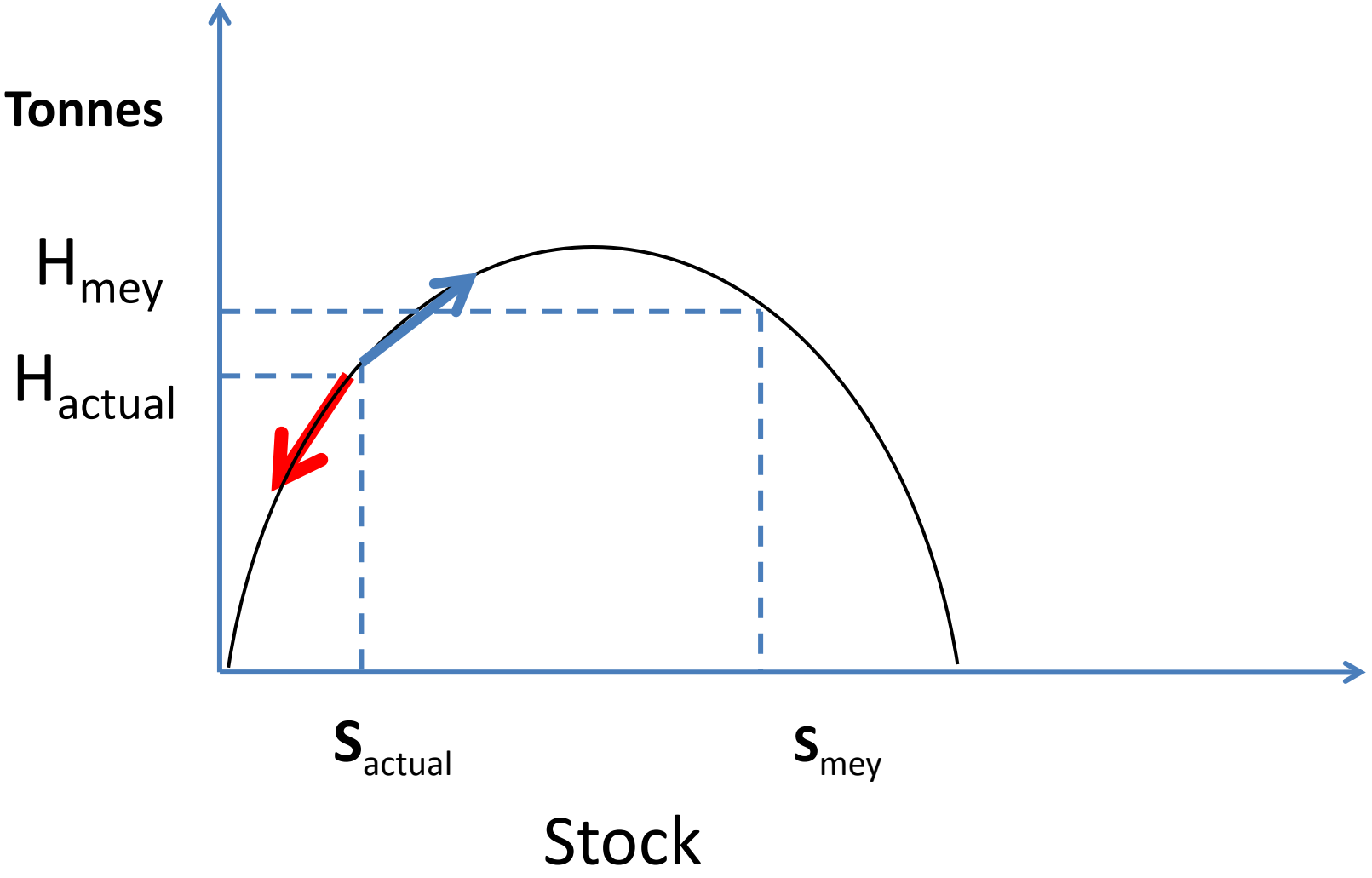
What is the economic value of reducing fishing effort, rebuilding tuna stocks and establishing a sustainable harvesting regime at B_{mey}?

Invoke Decision Rule (from Lecture 1)

Decrease catch if:

Value decreased catch **<** Value increased future catches

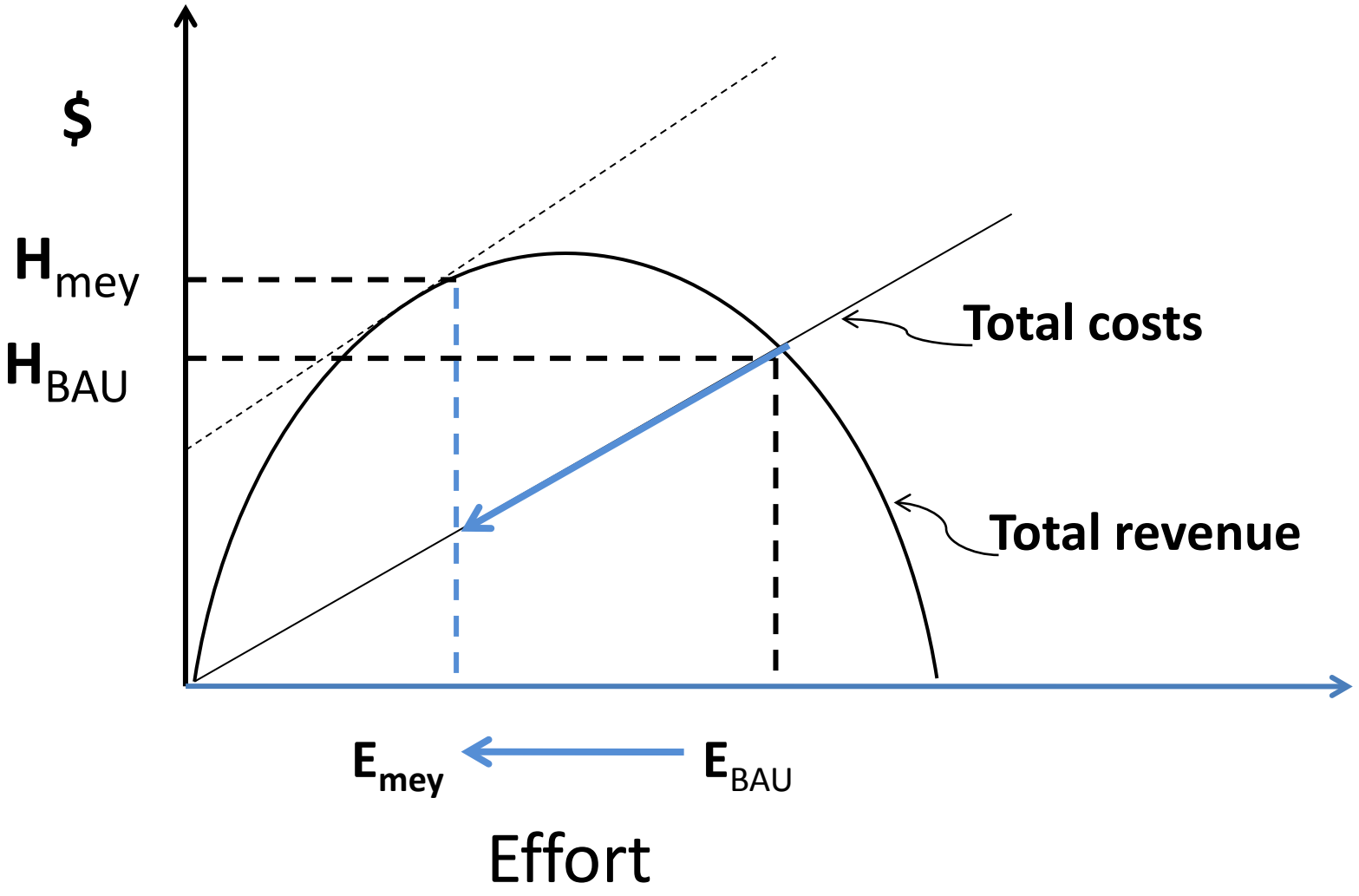
Rebuild stocks in first years



Biological parameters for B_{mey} modeling

- **Fishing mortality**
- **Natural mortality**
- **Recruitment**
- **Biomass current**
- **Biomass virgin**

Compare MEY and BAU



Economic parameters derived for B_{mey} modeling

- Price of tuna in different markets (purse seine, frozen longline, fresh longline)
- Elasticity of price
- Fishing costs (labour, material, capital, etc.)
- Planning horizon
- Discount rate (applied to future economic profits)

Bioeconomic modeling requirements for answering research question

1. **B_{mey} targets for main tuna species**
2. **Profit while building stocks to B_{mey}**
3. **Profit at sustainable H_{mey} at B_{mey}**
4. **BAU profit estimated for comparison with profit at B_{mey}**

Results of bioeconomic modeling, Tuna WCPO, Kompas, Grafton and Che (2010)

Table: Profit optima for tuna, WCPTF

Fleet		Optimum effort as % base year (Base year 2006=100)	Optimal effort allocation species		
			Yellowfin	Bigeye	Skipjack
Purse seine					
	In first 5 years	43.5	20	20	60
	Steady state	46.1	24.7	23.6	51.7
Frozen longline					
	In first 5 years	39.9	41.3	58.6	
	Steady state	55.2	44.6	55.4	
Fresh longline					
	In first 5 years	50.6	44	56	
	Steady state	60.6	45.6	54.4	

Results continued - Biomass ratios

Biomass ratios	Yellowfin	Bigeye	Skipjack
B_{mey}/B_{msy}	1.19	1.8	2.47
B_{mey}/B_{cur}	1.59	1.22	1.15

Yellowfin tuna and bigeye tuna are overfished
in an economic sense
because
BMEY > BCUR

The case of skipjack (1)

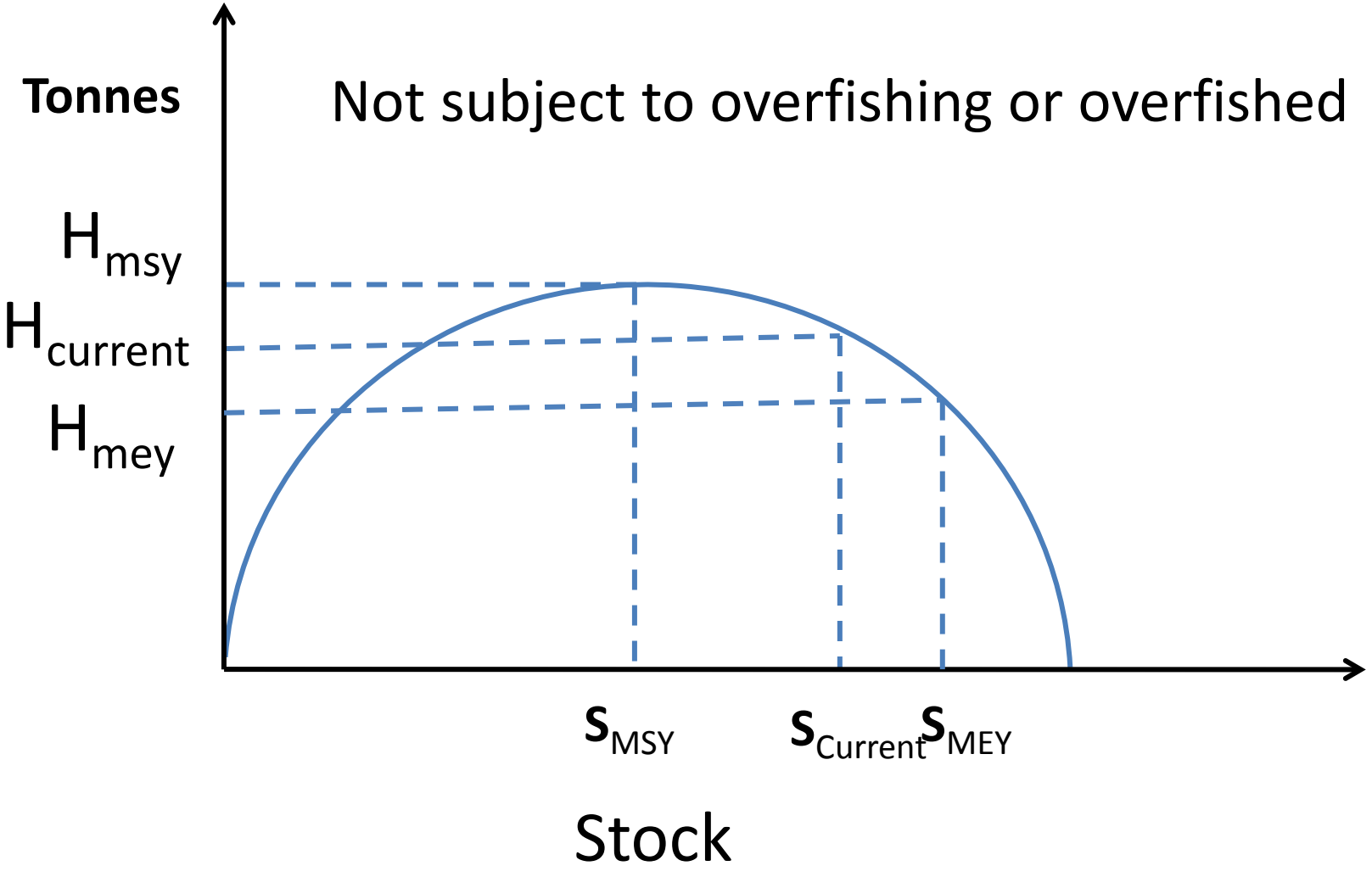
Biomass ratios

$B_{mey/}B_{msy}$	2.47
B_{mey}/B_{cur}	1.15

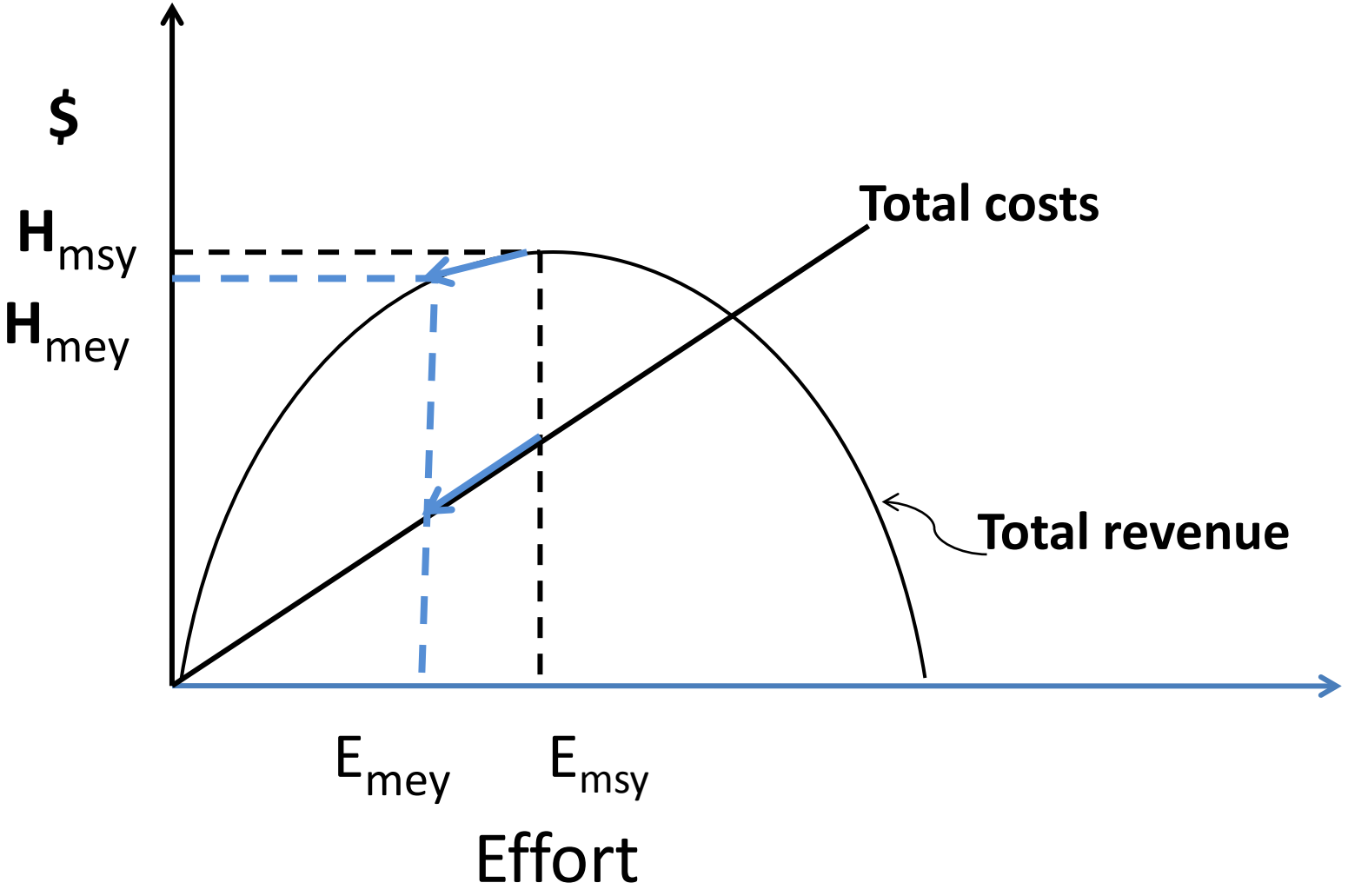
Skipjack not overfished or subject to overfishing, given that B_{mey} is not much different to B_{cur} and is far greater than $B_{msy.}$

However, increased biomass of skipjack makes it easier to catch fish, i.e. an increased biomass would lower costs and hence enhances expected profits.

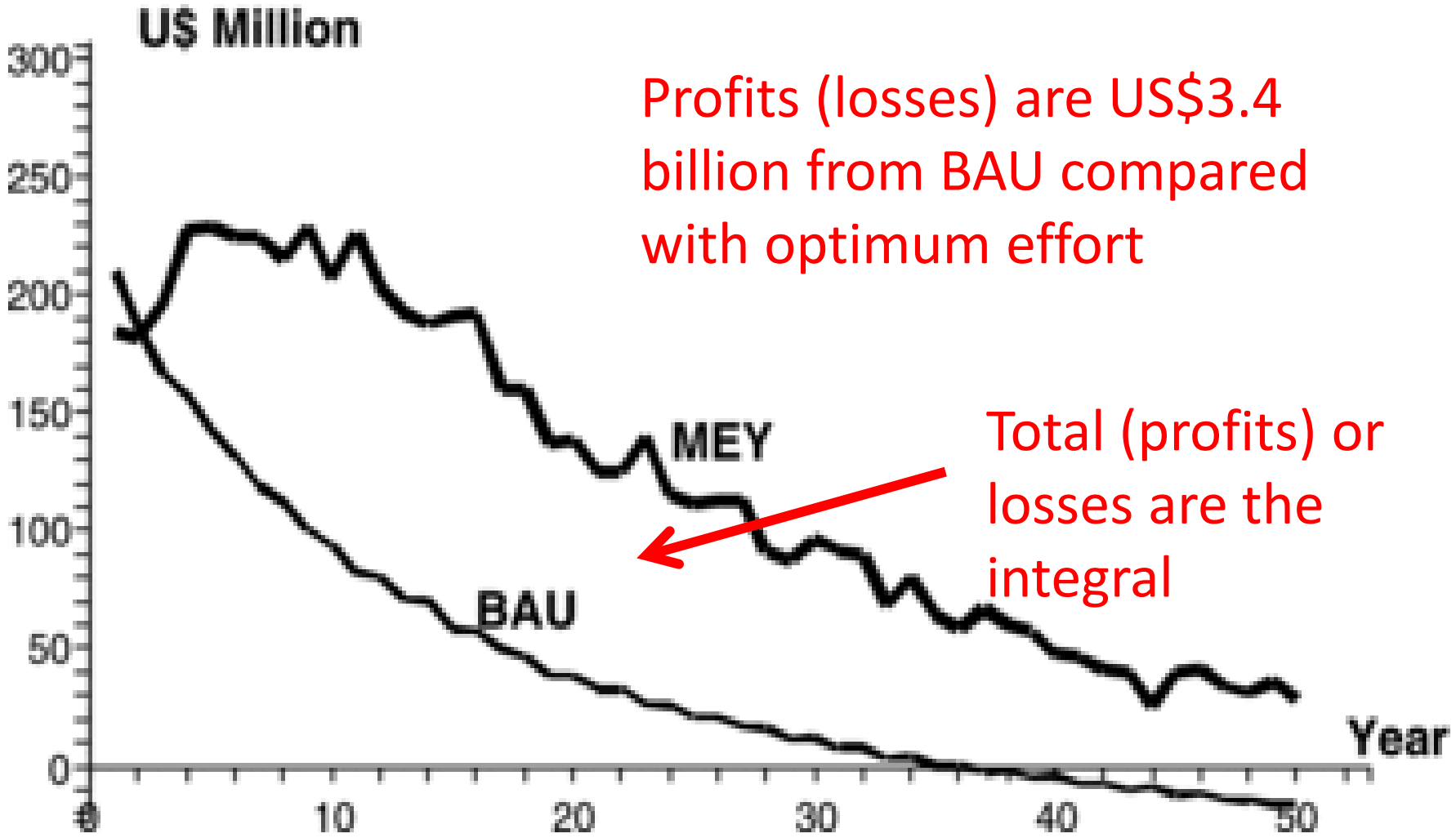
The case of skipjack (2)



The case of skipjack (3)



Net present value of profit (2008 prices in US$ millions) of sustainable fishing at B_{mey} versus BAU, WCPTF



Conclusions

- A reduction in fishing effort for each of the three main tuna species in the WCPTF would increase profits (or reduce future losses).

- A reduction in fishing effort would also enhance the conservation of tuna species (Precautionary Principle.

- A reduction in tuna fishing would reduce bycatch (see Lecture 2).

Question for Kompass et al

Can the optimal effort allocation be achieved in a multispecies fishery?

What do you think?

The cost of overfishing, continued…

The case of broad bill swordfish (*Xiphius gladius*) in the Eastern Tuna and Billfish Fishery

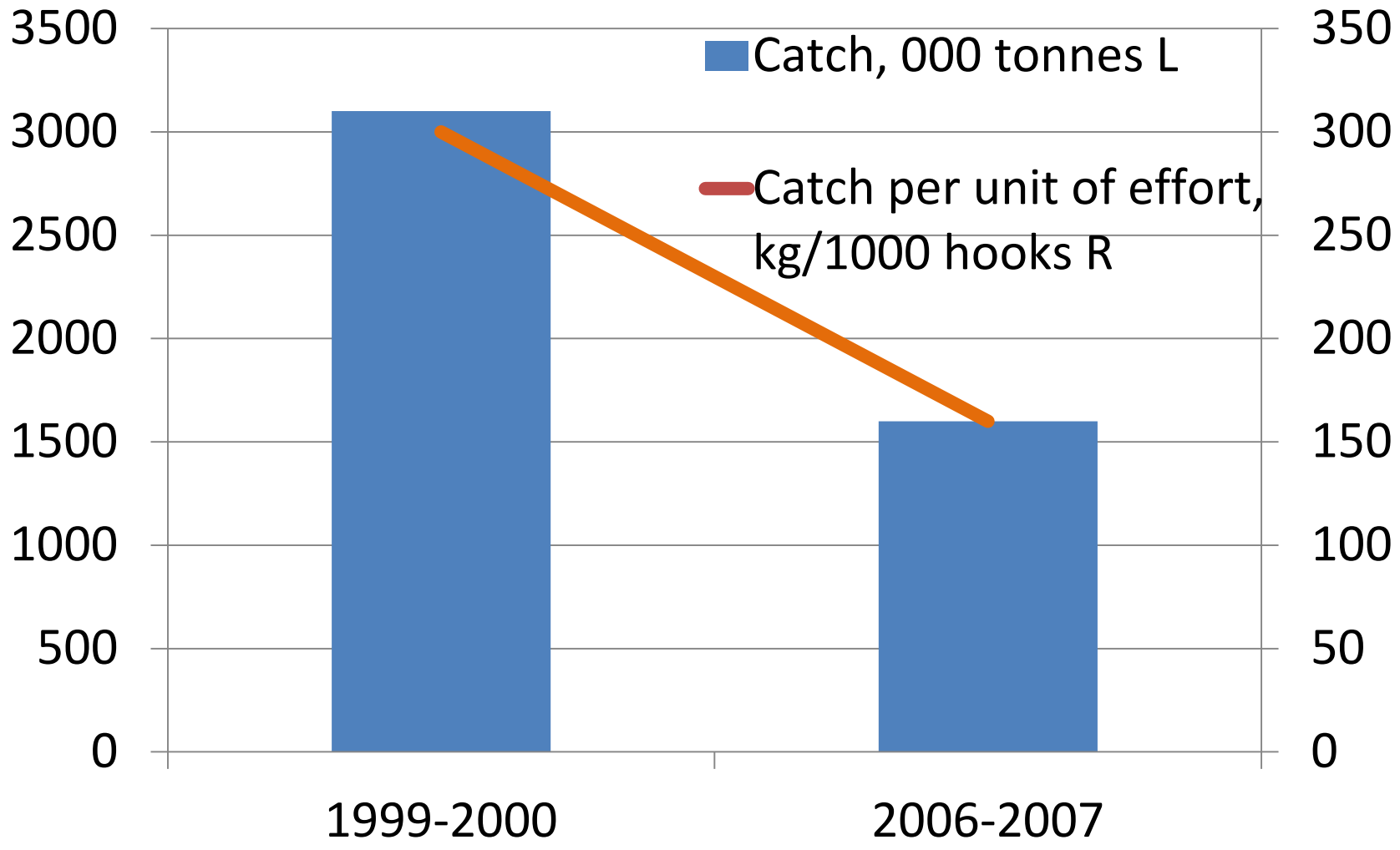
Eastern Tuna and Billfish Fishery

Management of ETBF

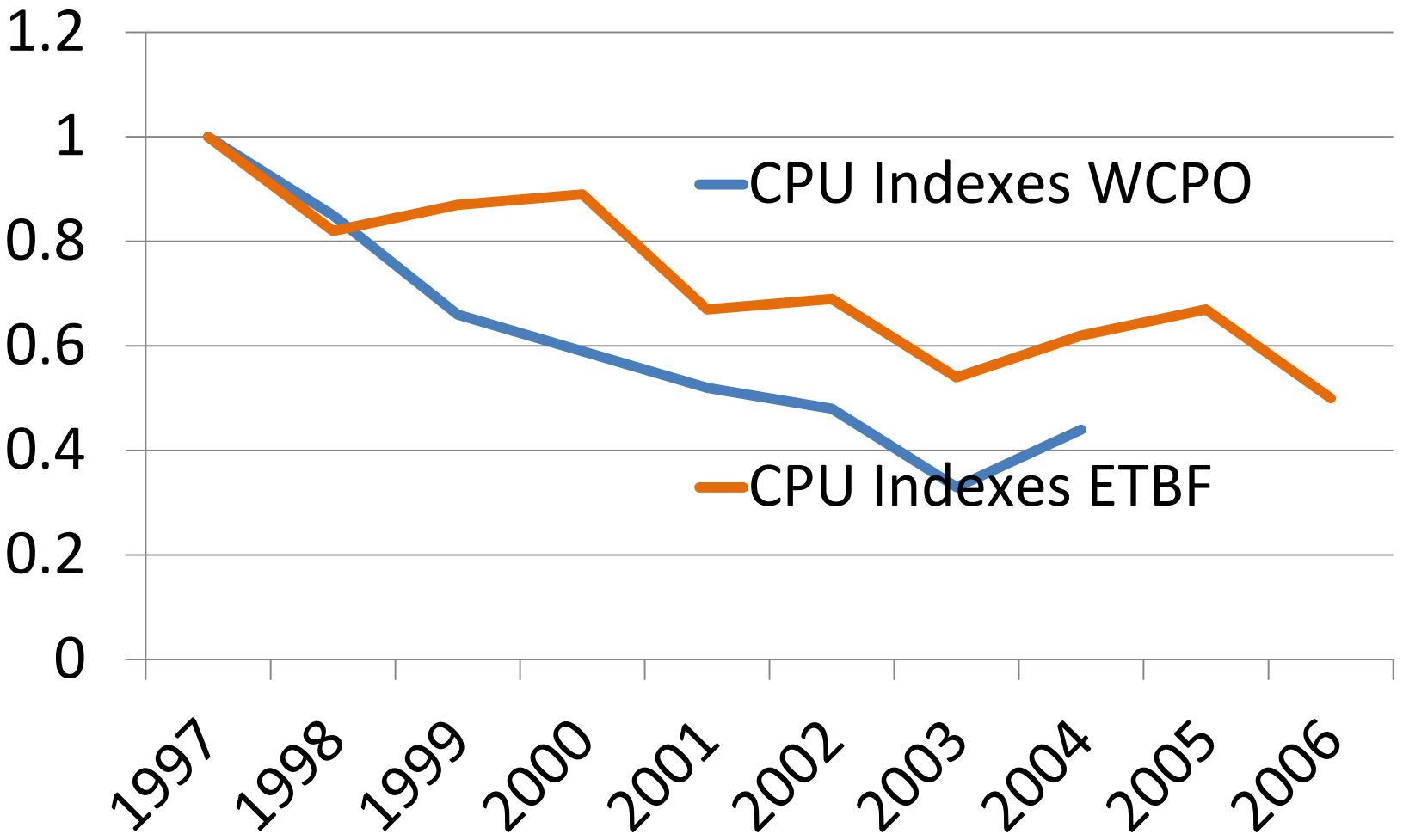
Australian Fish Management Authority (AFMA)

TAC (competitive)

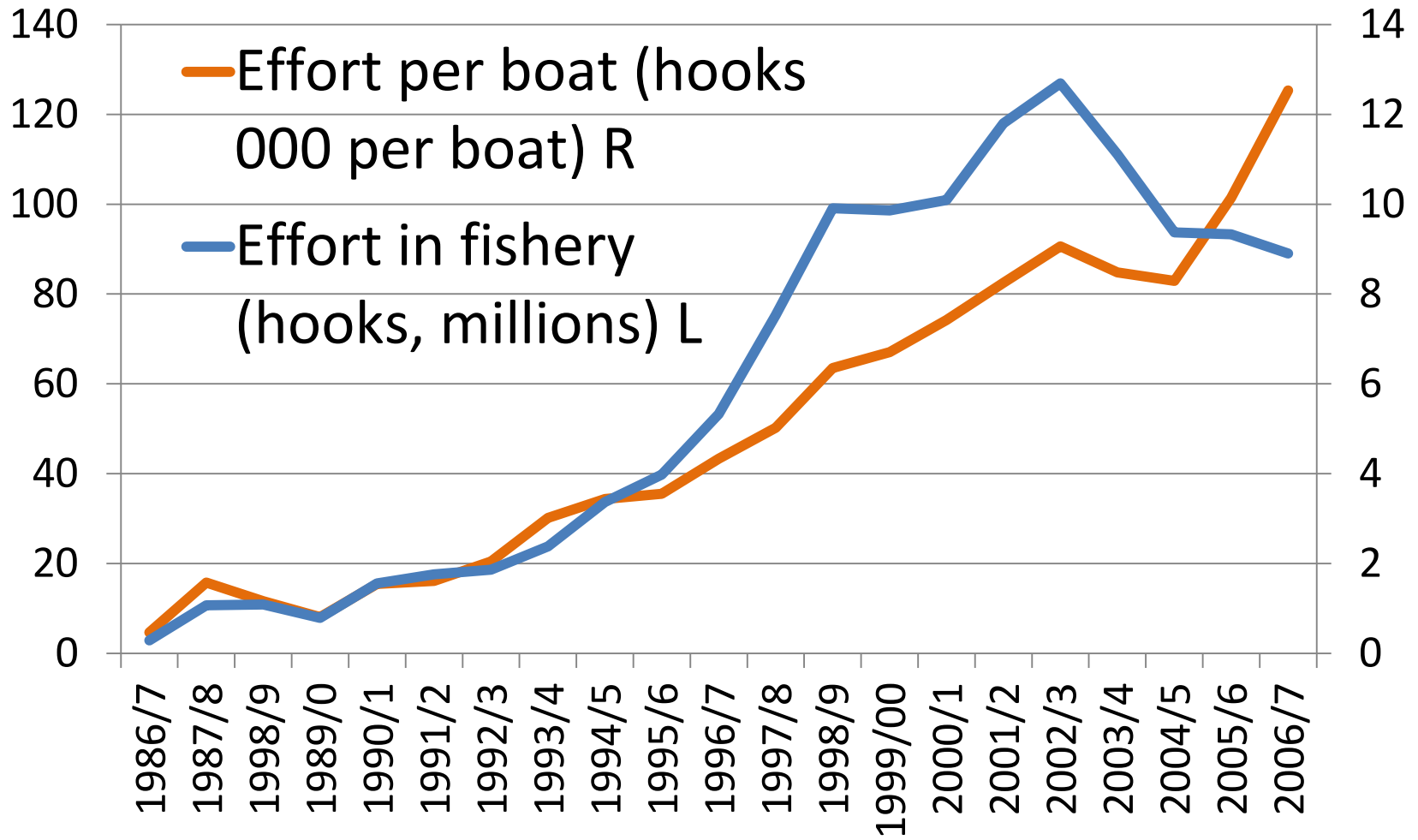
Catch and CPU broad bill swordfish



CPU ETBF and WCPO



Fishing effort and effort per boat



Commonwealth's assessment of ETBF

Not overfished or subject to overfishing in south west Pacific.

But note:

- Adult biomass estimated to have declined by 42% in 2007 from unfished levels.
- Spawning biomass estimated to have declined by 57%.
- Biological parameters remain poorly quantified.

Research question

What has been the economic cost of "overfishing" on broadbill swordfish in the ETBF?

Data for modeling profits

Indexes for the average swordfish vessel over time, 1989/90-2005/06:

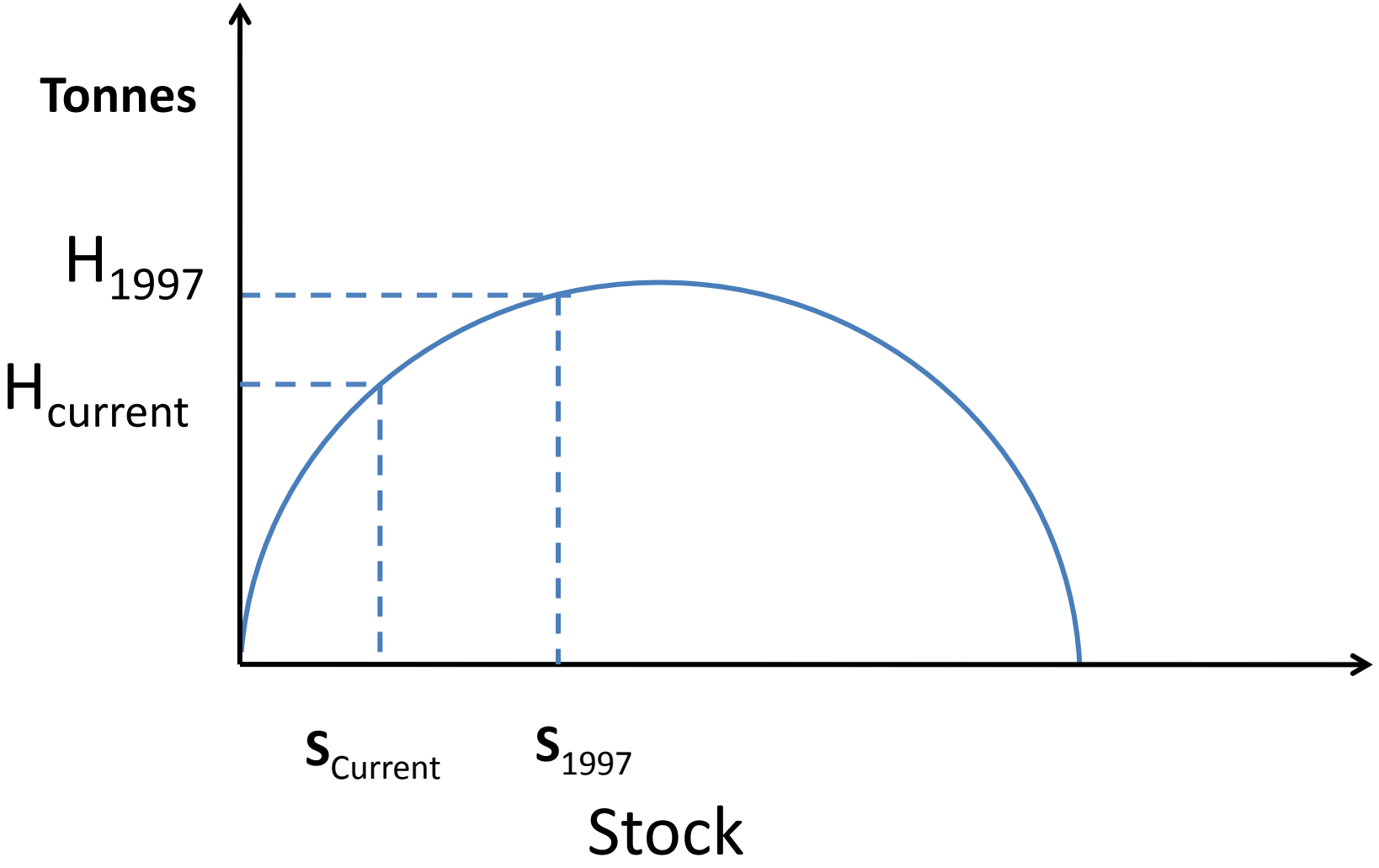
- Profit — increased then declined
- Productivity — increased then declined then increased
- Output price — constant
- Prices of inputs — fuel increasing
- Capital — increased then declined
- Stock of fish — declined then slight rise

Economic modeling, with and without depletion, for period 1997/8 to 2006/7

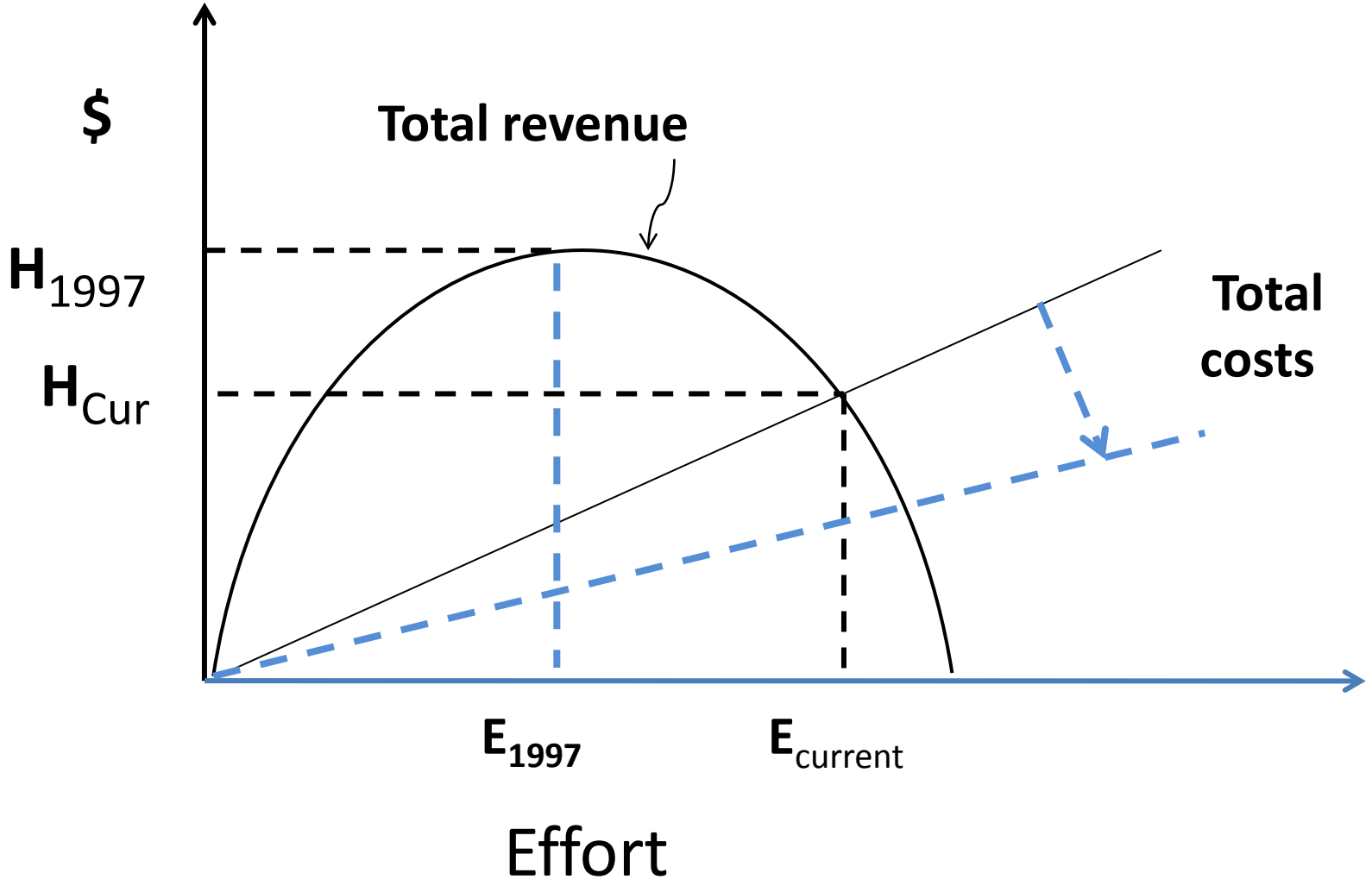
With depletion:
Actual stocks
(proxy is CPU)

Without depletion:
Stock at 1997 level

Compare $S_{current}$ and S_{1997}



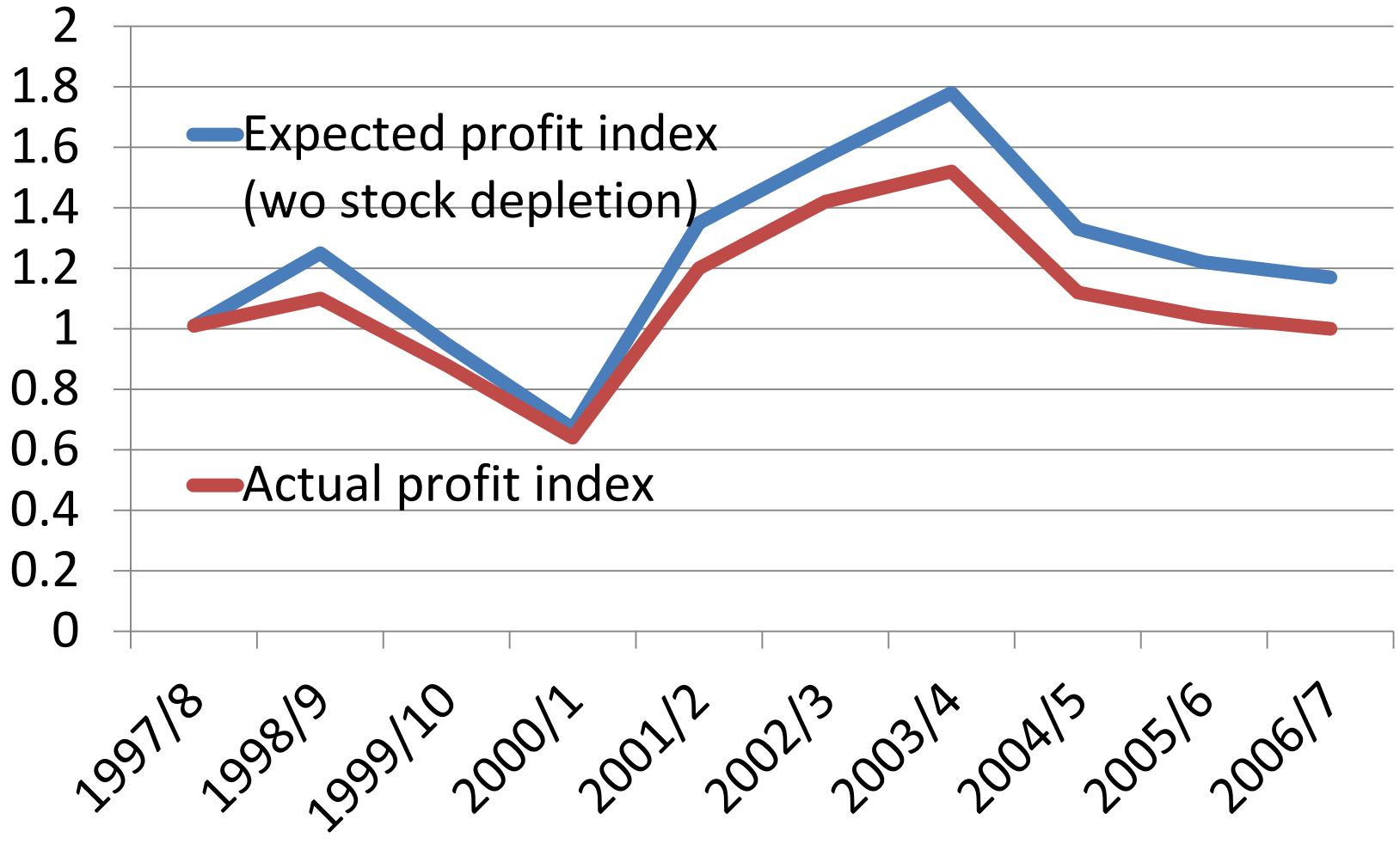
Compare $E_{current}$ and E_{1997}



Results

Lower CPU lowers costs per tonne of swordfish and increases profit

Modeling impact of stock depletion on average income per vessel



Profit foregone (or loss) due to overfishing over period 1997/8 to 2006/7

$56,000 on average per year per vessel

$5.1 million on average per year for fishery

Key messages

- **Pose the research question**
- **Derive parameters for bioeconomic modeling (biological and economic)**
- **Estimate MEY**
- **Assess economic gains from better management ,even when stocks are officially assessed as not overfished or subject to overfishing.**
- **Note Methodologies:**

Case study 1. Forecast <u>future</u> increase in profits (reduction in losses), therefore discounting comes into play.

Case study 2. <u>Retrospective</u> look at profits foregone or losses made.