COULD A MANAGEMENT PROCEDURE APPROACH EASE PROBLEMS IN THE MANAGEMENT OF US FISHERIES?

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OUTLINE

I. The traditional and MP approaches to fisheries management

II. The MP approach: computation and structure

III. Some aspects of MPs

- Associated necessities
- Model-based *vs* Empirical
- Problem areas

IV. Examples

- South African hake
- North Sea sole
- American plaice

V. USA setting: Positives and hurdles

I. THE TRADITIONAL AND MP APPROACHES

MP = Management Procedure

Approach first developed in the Scientific Committee of the International Whaling Commission some 15 years ago for improved management of fisheries by taking proper account of uncertainties in line with the Precautionary Principle, as later endorsed by FAO.

What is the traditional approach used to make scientific recommendations for TACs for fisheries ?

a) Assess resource ⇨ abundance, productivity

b) Apply HCR ⇨ TAC recommendation

What particular difficulties arise with the traditional approach ?

a) Variability in "best" assessments (and hence TACs)

b) Ignores longer term trade-offs

c) Lengthy haggling

d) What if "best" assessment is wrong ?

e) Default decision: no change

What is an MP ?

- Formula for TAC recommendation
- Pre-specified inputs to formula

But isn't this the same as the traditional approach ?

Almost, but not quite

So what's the difference ?

a) Pre-specifications prevent haggling

b) Simulation checks that formula works even if "best" assessment wrong

How is the MP formula chosen from amongst alternative candidates ?

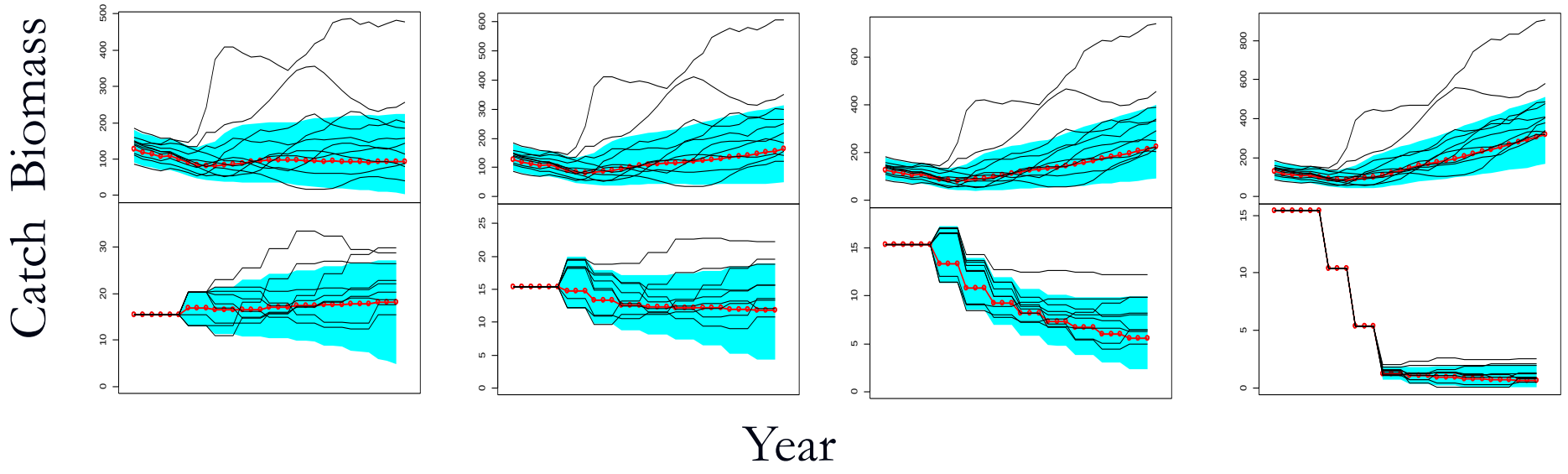
a) Compares simulated catch / risk / catch variability trade-offs for alternatives

b) Checks adequate for plausible variations on "best" assessments

SOUTHERN BLUEFIN TUNA EXAMPLE

TRADE OFF

More catch ⟵ ⟶ More recovery



Different HCR options

What are the advantages of the MP approach ?

a) Less time haggling of little long term benefit
b) Proper evaluation of risk
c) Sound basis to impose limits on TAC variability
d) Consistent with Precautionary Principle
e) Provides framework for interactions with stakeholders, particularly re objectives
f) Use haggling time saved towards more beneficial longer term research

What are the disadvantages of the MP approach ?

a) Lengthy evaluation time

b) Overly rigid framework (though 3-5 yearly revision)

BUT

Provides default

When should scientists change the TAC recommendation from a MP?

New information / understanding shows real resource situation is outside range tested

A MP is like an auto-pilot

BUT

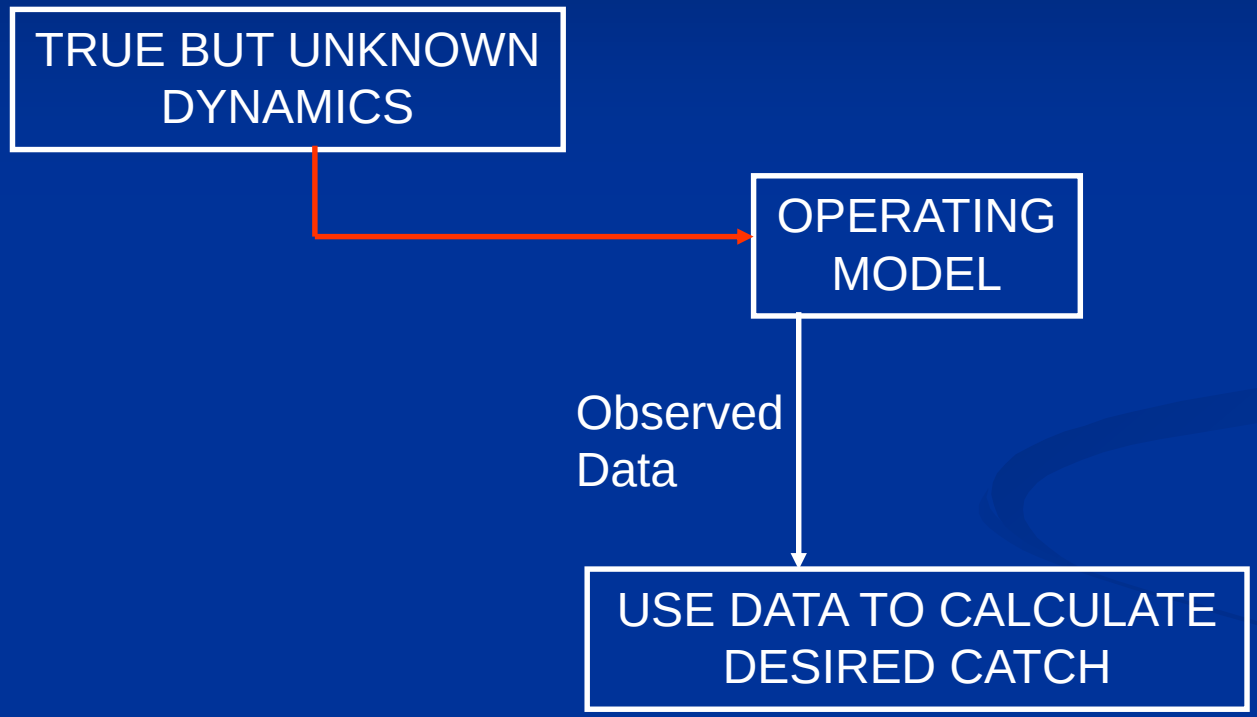
The real pilot remains to check that nothing unanticipated has occurred (i.e. annual routine assessments continue)

How should managers react to MP-based scientific recommendations ?

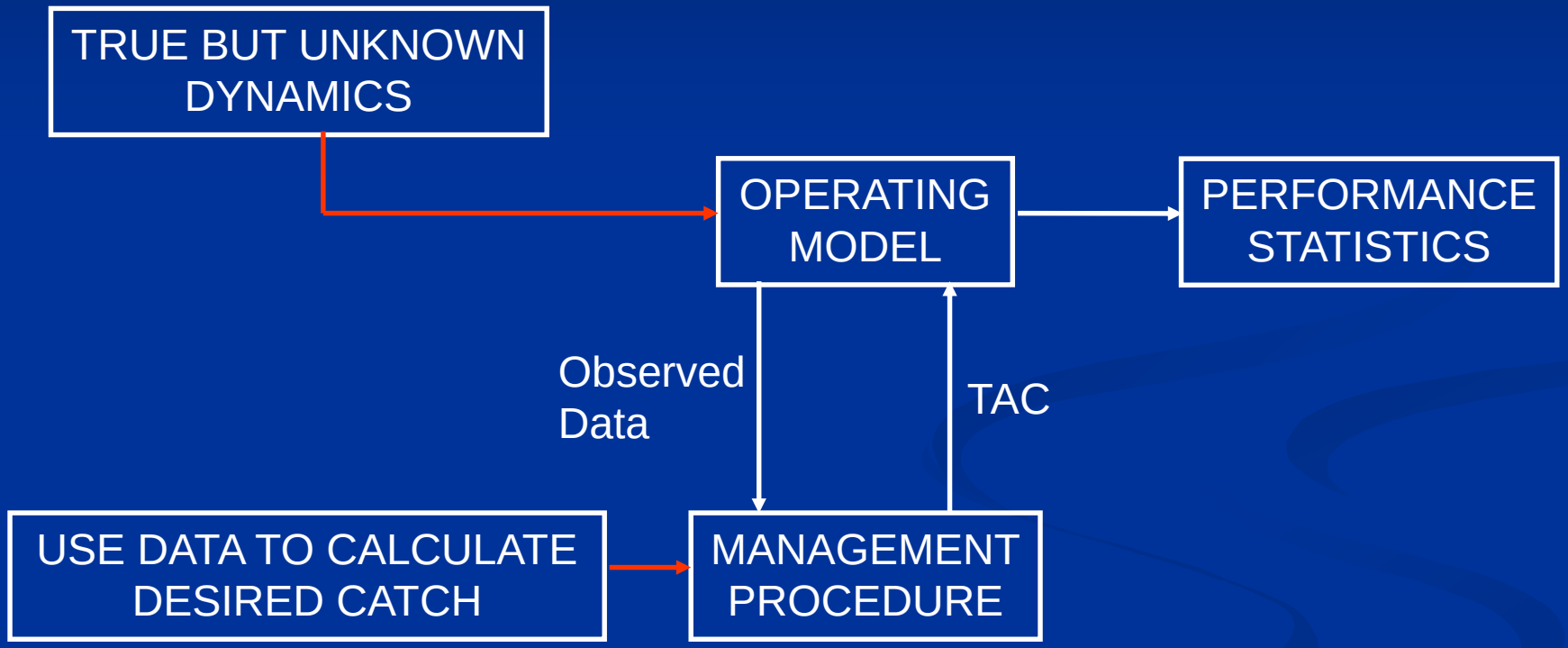
a) Treat as default (replacing “no change”)

b) Require compelling reasons to change

II. THE MP APPROACH: COMPUTATION STRUCTURE



The Management Procedure Approach



- Uncertainties reflected by different operating models for "reality"
- Management procedure must produce satisfactory performance across a range of plausible operating models

Objectives for Management

- High catch
- Small chance of reducing resource to low level
- Small changes in catch from year to year

Conflicting → Trade-offs

Aim

Find a management procedure which:

- Provides desired trade-offs
- Is (through feedback) reasonably robust in achieving this performance to changes in the operating model (underlying reality)

How it works

- Operating model
  - provided by alternate assessments
- Management procedure
  - Model-based: simple population model fit and HCR
  - Empirical (e.g. adjust TAC based on trends in abundance indices)

IIIa. ASSOCIATED NECESSITIES

PRE-AGREED PROTOCAL

- Regular review schedule
  - About 5-yearly
- Specifies computation adjustments if data anticipated are not forthcoming
- "Exceptional circumstances" provisions
  - When MP output may be overridden and/or review advanced
  - Criteria – essentially: situation outside range tested

ASSOCIATED NECESSITIES

DEVELOPMENT SCHEDULE

- Lengthy process compared to assessment (~1 year rather than ~1 week)
- No back-tracking after "milestones" achieved of:
  - Agreeing data and broad range of hypotheses/uncertainties
  - Finalising operating models and fitting them to data

STAKEHOLDER INVOLVEMENT

- Interactions with managers, industry etc. from day one
- Focus on quantifying trade-offs, and associated preferences
- Being part of process ⟶ More likely to accept outputs

IIIb. MODEL-BASED *vs* EMPIRICAL MPs

IWC: RMP – simple production model approach preferred over empirical approach

Primarily for lower catch variability

CCSBT: First MP selected was Fox production model–based plus empirical adjustments; preferred over purely empirical options

Primarily for better learning about stock productivity

x

YET

SOUTH AFRICA: Model-based approaches are being replaced by (and trend elsewhere) Empirical ones – why?

WHICH IS BETTER?

POPULATION MODEL POSITIVES

- Better representation → More precise estimation
  → Less TAC variability
- Improved estimation of productivity over time (learning)

BUT

POPULATION MODEL NEGATIVES

- As data increase, simple models don't capture dynamics well
- Insufficiently sensitive to recent trends
- Can't check convergence of estimated model fits in trials

PREFERENCE FOR EMPIRICAL

- Quicker trials
- Handle 'learning' by adjusting control parameters in 4-5 year reviews
- More transparent/easily understood by industry and managers; the way inputs impact outputs is clearer
- ? Raw indices or model-refined (e.g. current SBT) ?

SLOPE- *vs* TARGET-BASED

Slope: TAC change related to index trend (regression slope)

Target: TAC change related to [current – target] index value

TARGET-BASIS GENERALLY PREFERABLE

Less TAC variability for no additional resource risk

IIIc. PROBLEM AREAS

RISK DEFINITION

- Probability of something undesirable happening
- Is a common currency across fisheries possible?
- Common currency can prove problematic even over time in the same fishery
  - e.g. Updates in estimates of the extent of variability in recruitment
- Over what range of uncertainties are probability estimates to be conditioned?
- Should be meaningful to non-scientific stakeholders

ROBUSTNESS

NO MP CAN BE ROBUST TO EVERY POSSIBLE SCENARIO

Avoid worst case scenario based management

→

Plausibility weighting for different scenarios (OMs)

- Difficulties of quantification and balance
- A pragmatic approach (IWC): H/M/L ranking
  - H – meeting all thresholds
  - M – meet lower thresholds
  - L - ignore

ROBUSTNESS

HOW WIDE A RANGE OF UNCERTAINTY TO CONSIDER IN TESTS?

- **Restrict to range indicated by past data**

  The unexpected does occur ⟶ Over-frequent recourse to "Exceptional Circumstances"

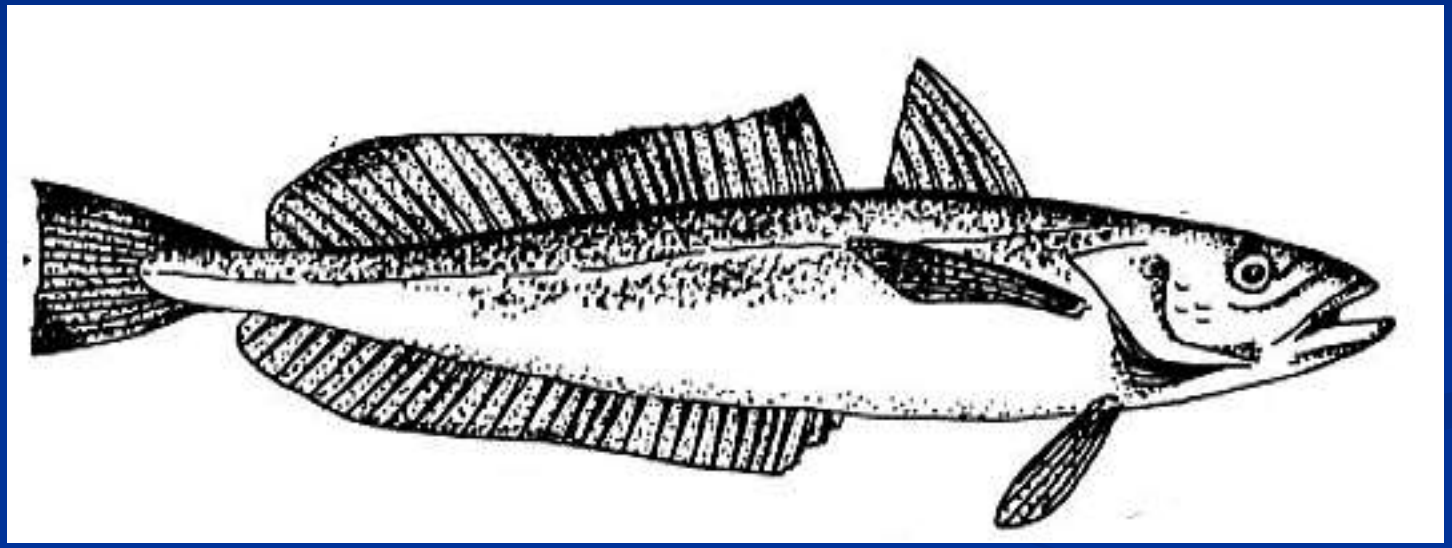
- **Widen range compared to past data indications**

  Extent of widening somewhat arbitrary

  TAC outputs are the more conservative as such extents are increased

  Endangers wide acceptability/buy-in

IVa. South African Hake Management Procedures

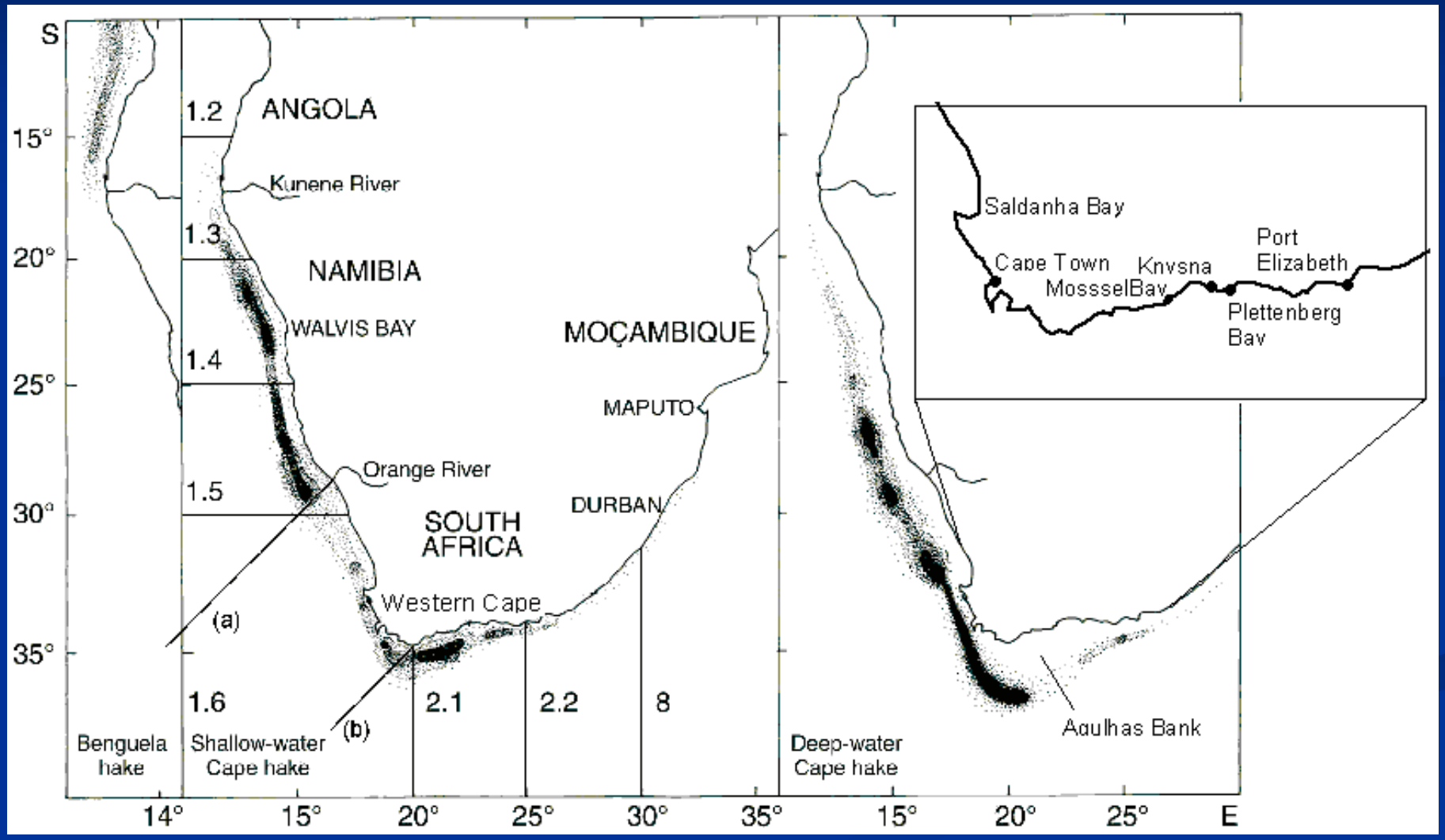


Actually two species:

M. capensis – shallow-water hake

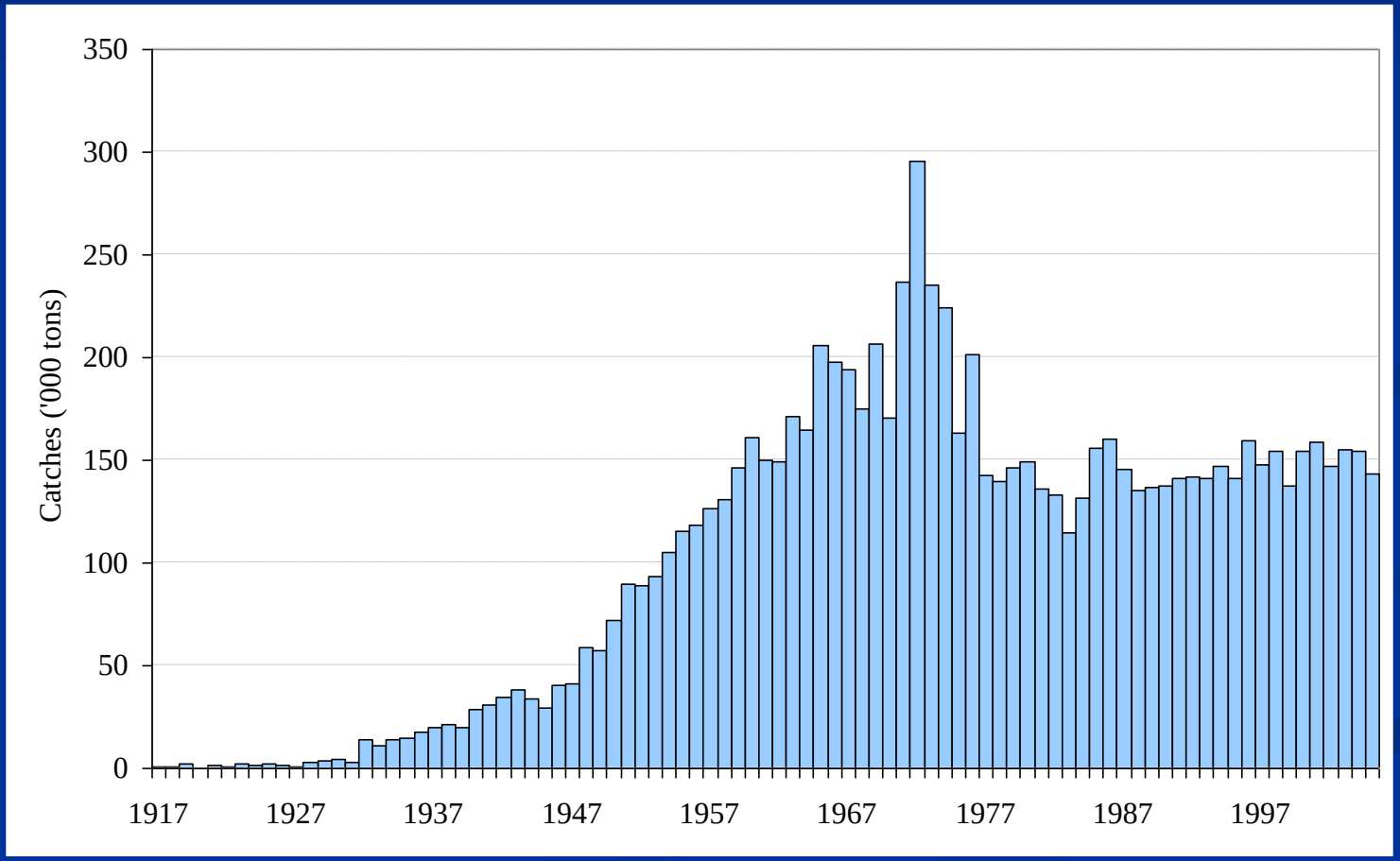
M. paradoxus – deep-water hake

HAKE DISTRIBUTION



Past Annual Catches

TAC for 2006: 150’000 tons



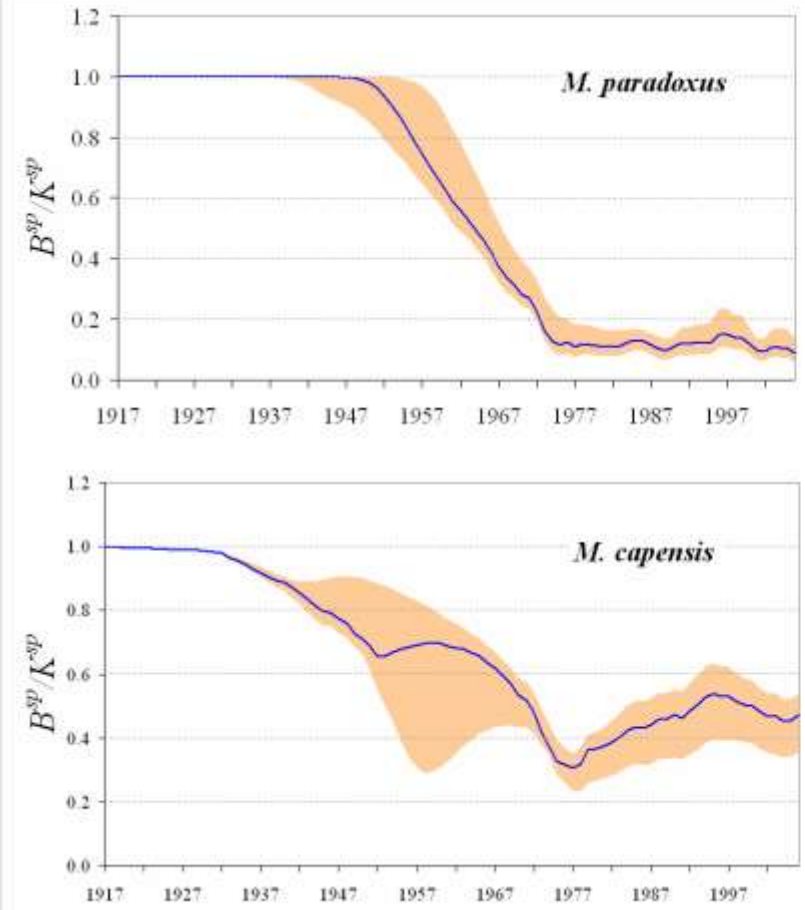
Major Uncertainties

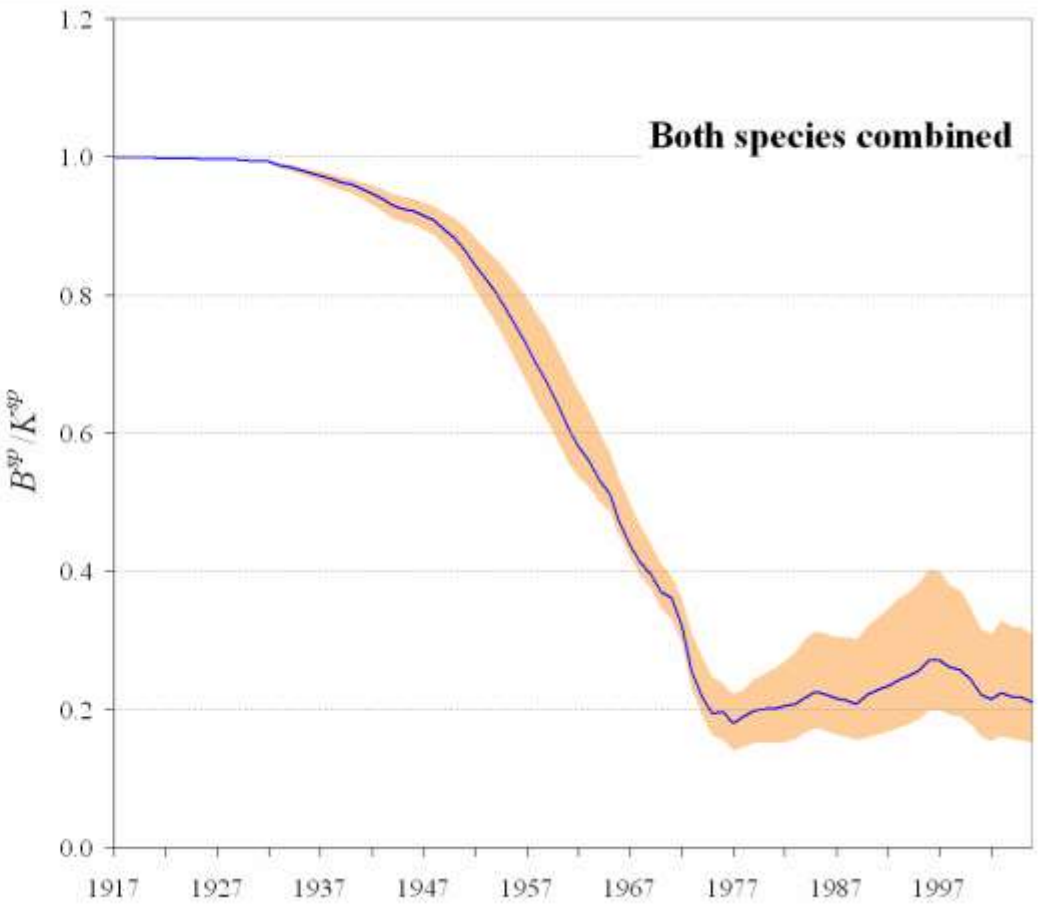
- Natural death rate ("Natural mortality")
- Split of catches between two species
- Shape of offspring-parent relationship ("Stock-recruitment curve")
- Recent recruitment levels

Results to be shown reflect 24 possible combinations of these factors

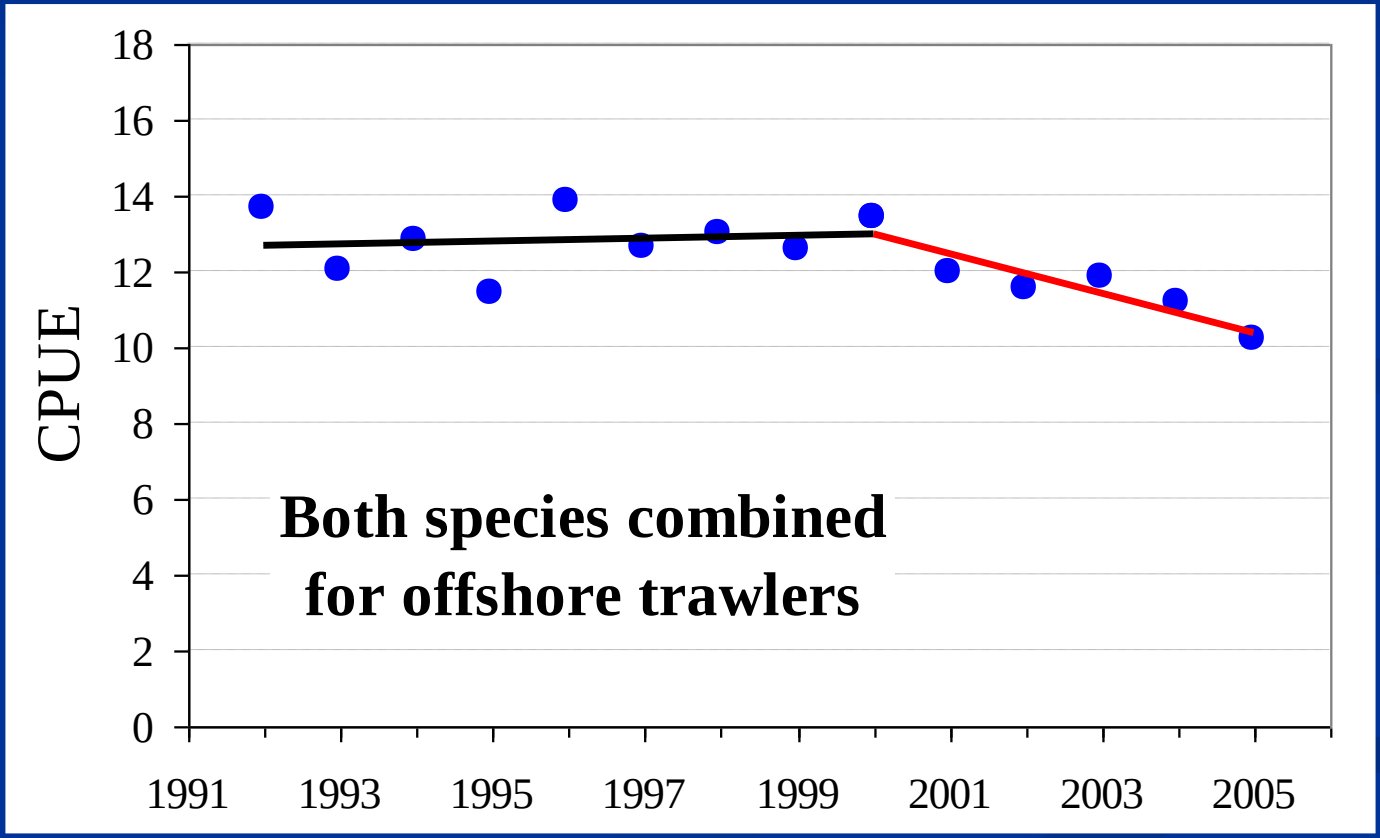
Past Resource Trends

Medians for spawning biomass B^{sp} with full range of values





What is the main problem for the industry?

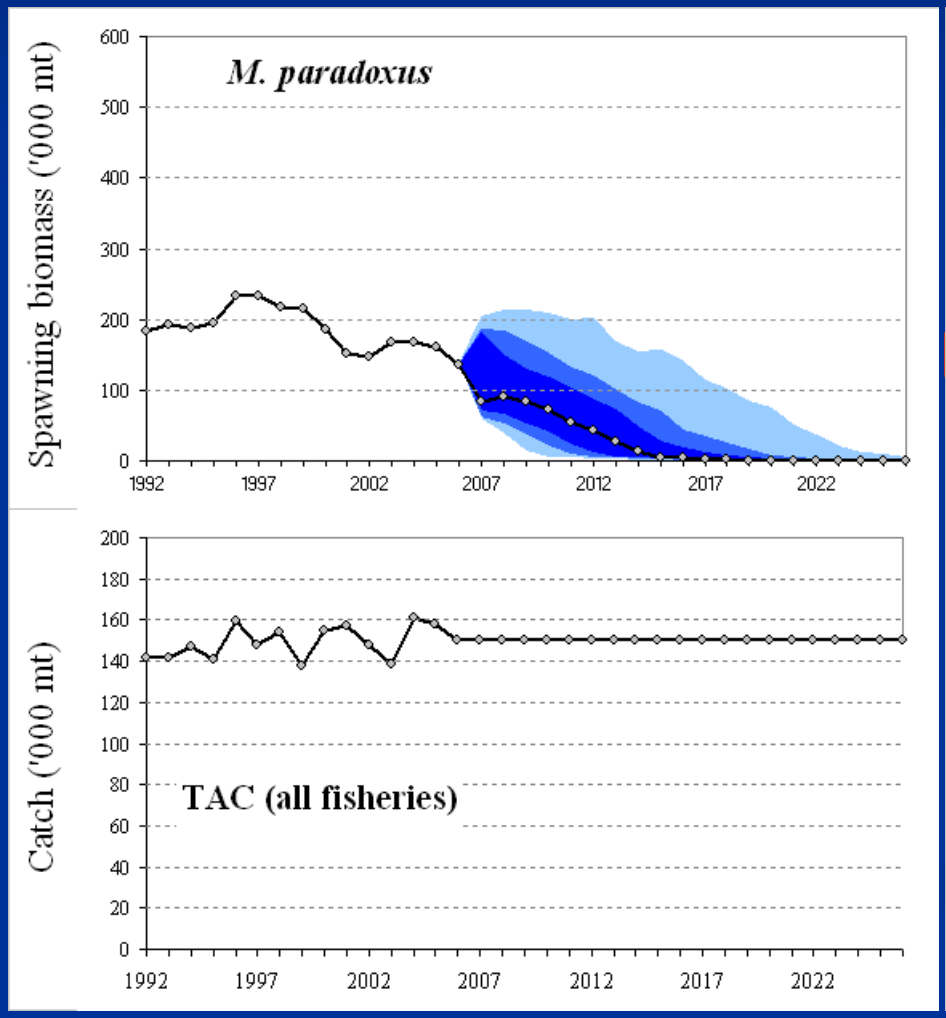


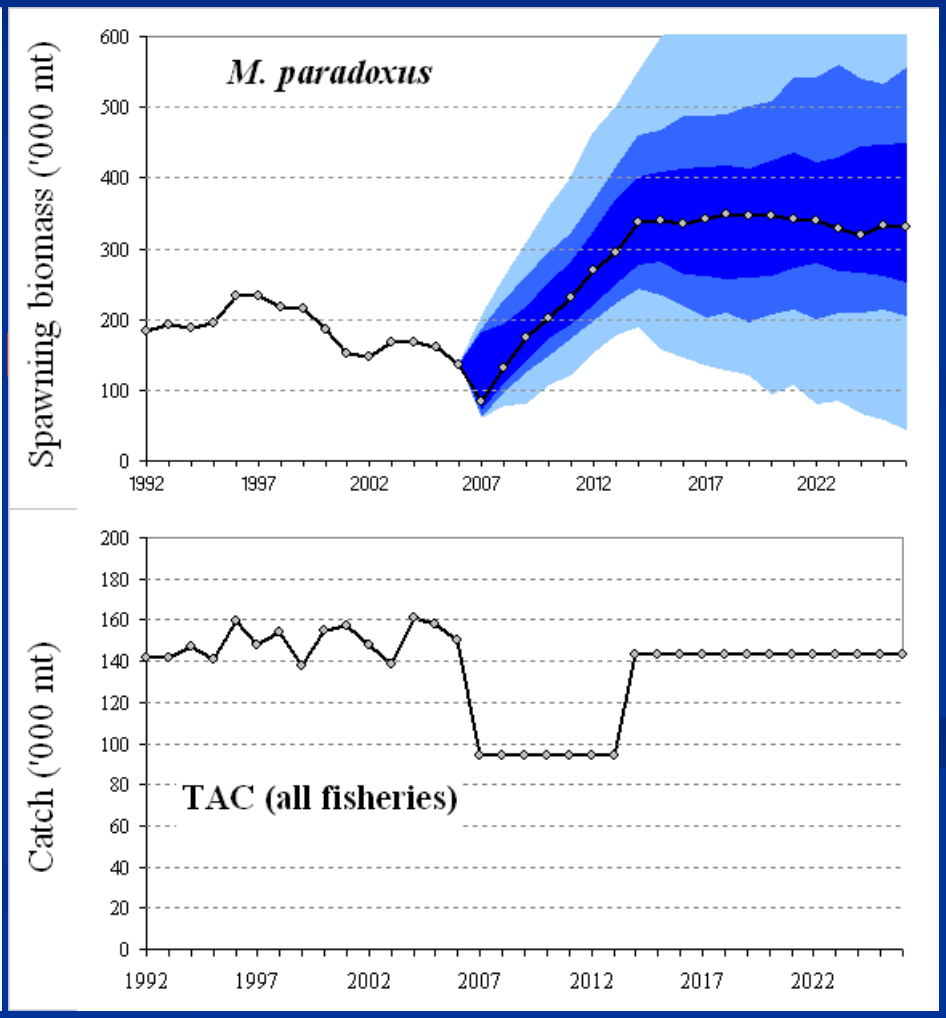
What can we do to solve the problem?

MAINTAIN CURRENT TAC

WSSD: RETURN TO MSYL BY 2014 IF POSSIBLE

What can we do to solve the problem?





Objectives

1. Get catch rates up quickly in the short-medium term

2. Get *M. paradoxus* back to MSYL over 20 years

3. After likely initial cuts to achieve 1), secure greater TAC stability over time.

Two OMP options

OMP details

- TAC changes up or down in response to last 5 years trend ($slope_y$) in CPUE and surveys
- Minimum rate of increase required for *M. paradoxus* before TAC might increase

$$TAC^s_{y+1} = TAC^s_y\left[1+\lambda_y\left(slope_y - slope_{\text{target}}(y)\right)\right]$$

$$s = capensis, paradoxus$$

$$\left|TAC_{y+1} - TAC_y\right| \le \mu TAC_y \qquad \mu = \begin{cases} \text{const} \\ \mu\left(\text{CPUE}_y\right) \end{cases}$$

Two OMP options

1) OMP1_20%:

- Median *paradoxus* recovery to 0.2*K*, lower 5%ile to 0.12*K* after 20 years
- Max TAC change ±10%

2) OMP2_21%:

- Median *paradoxus* recovery to 0.21*K*, lower 5%ile as for 1)
- 7.5% TAC reductions for 3 years; thereafter max change ±5% but can increase to 15% if CPUE goes low

Two OMP options

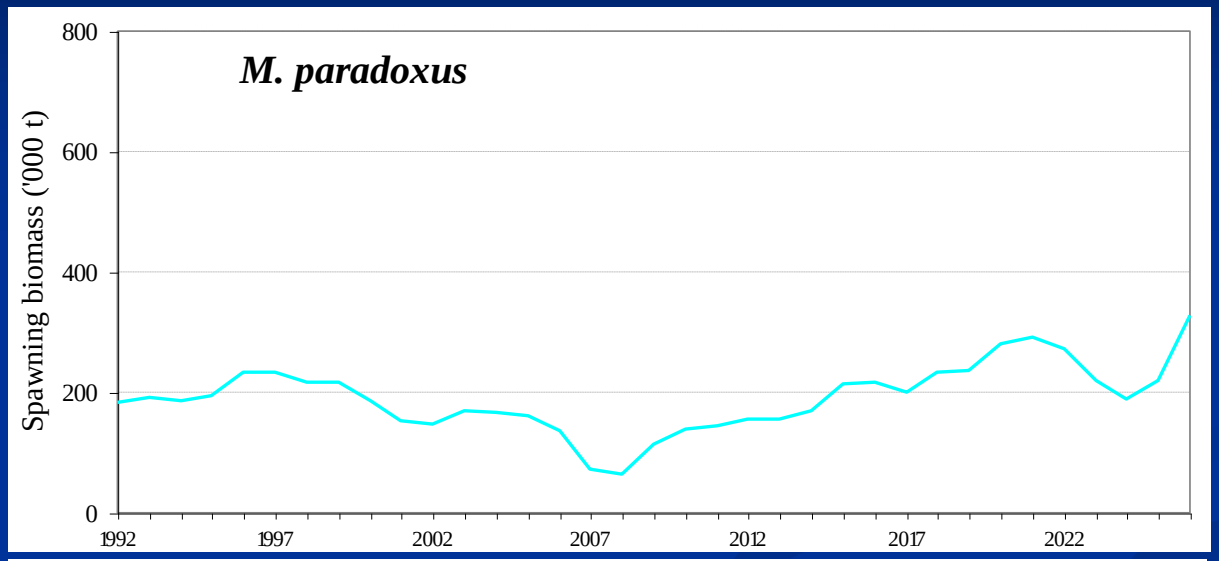
Essential trade-off

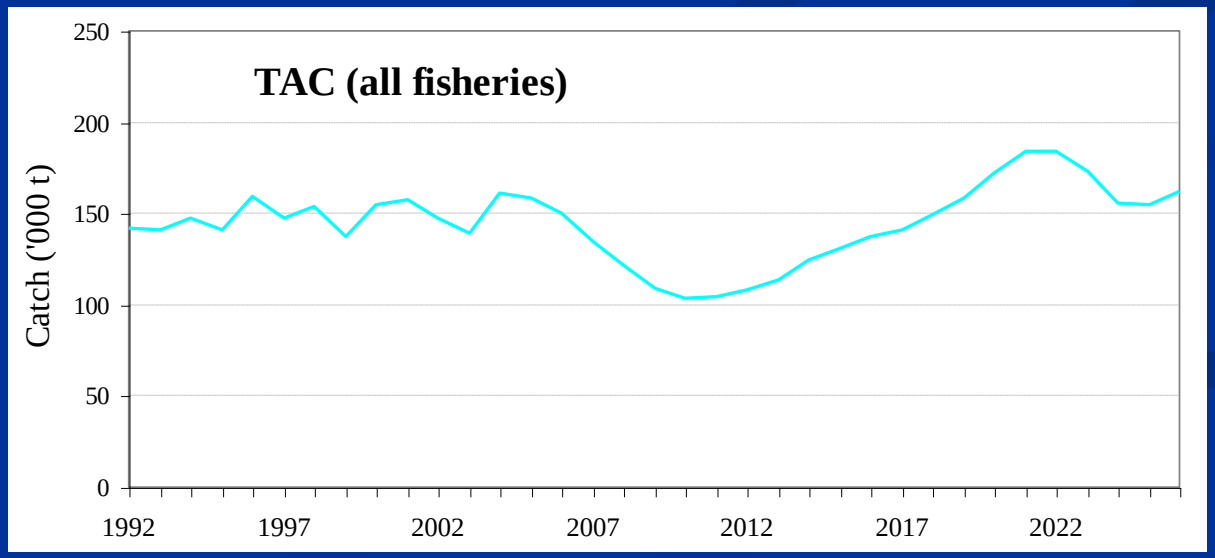
1) OMP1_20%: Higher TAC variability, faster CPUE recovery

2) OMP2_21%: Decreased TAC variability, same resource risk as 1), but lower average catch

Projections

OMP1_20%





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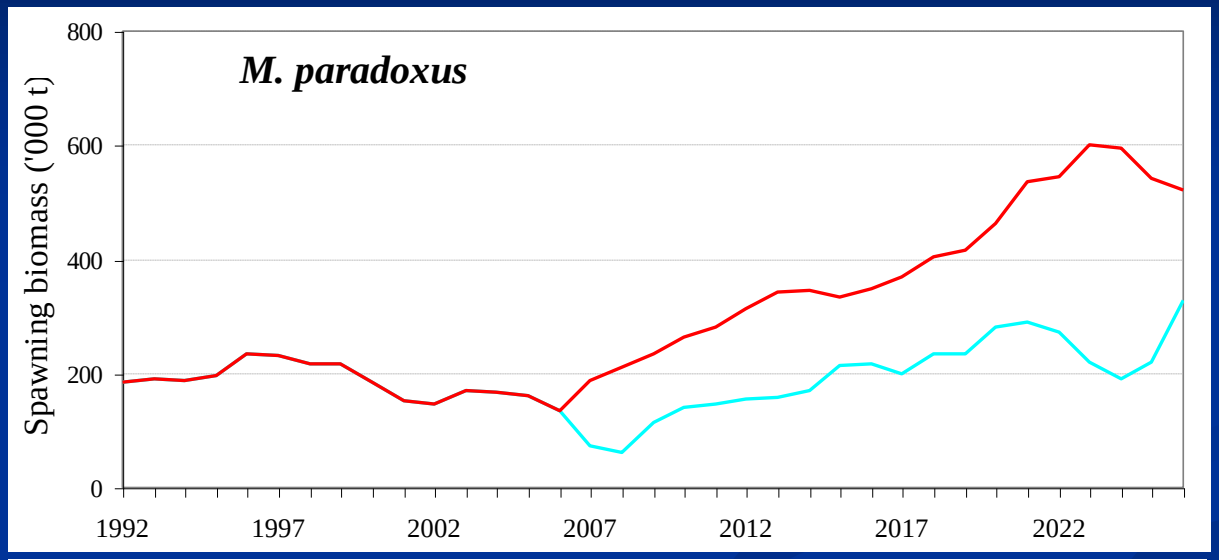

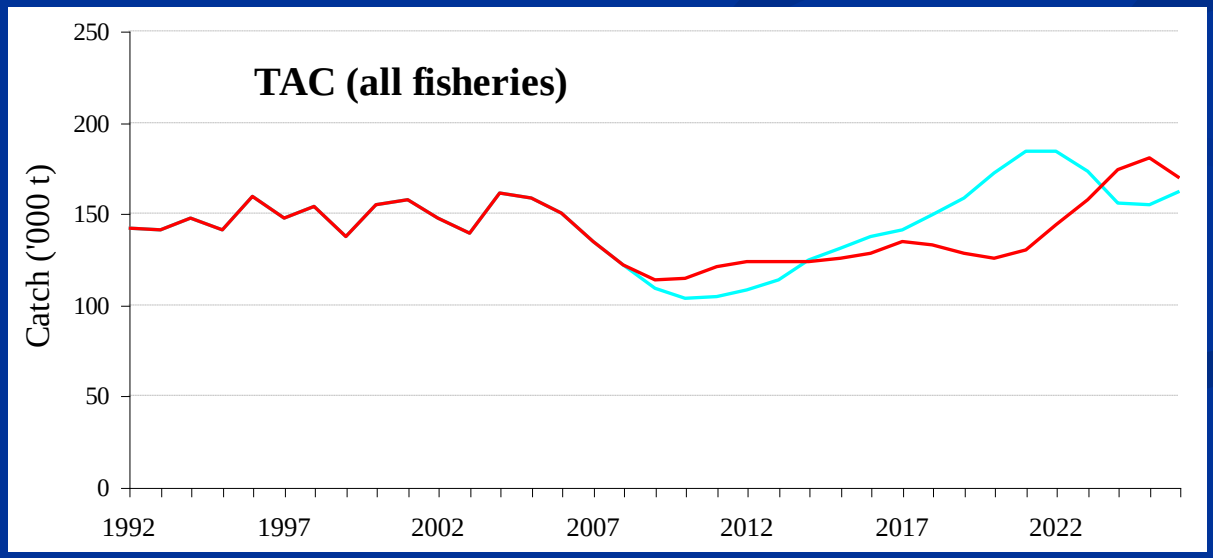

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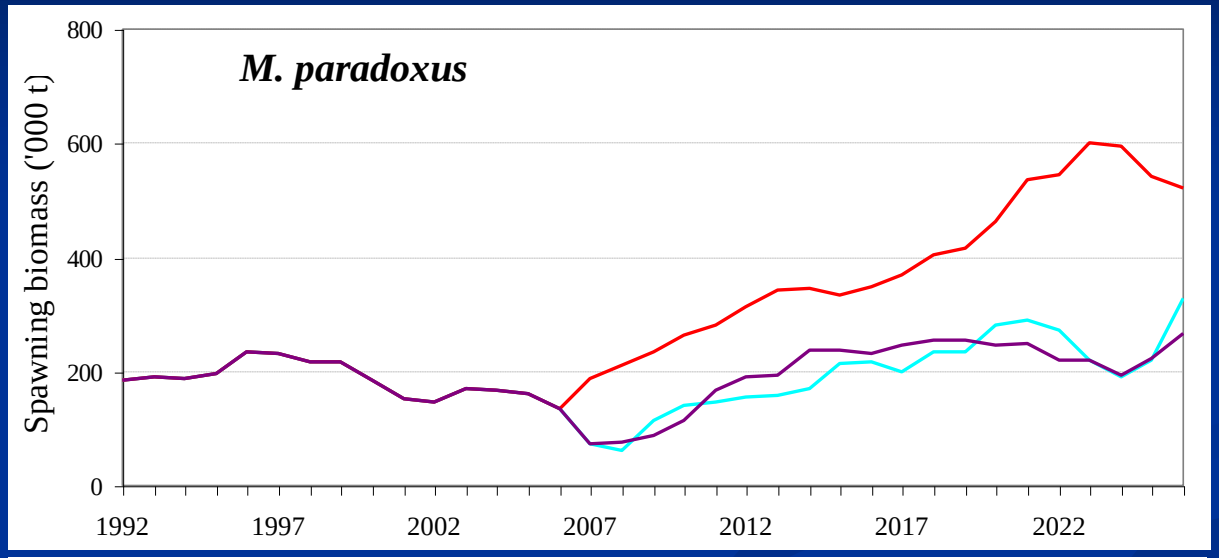

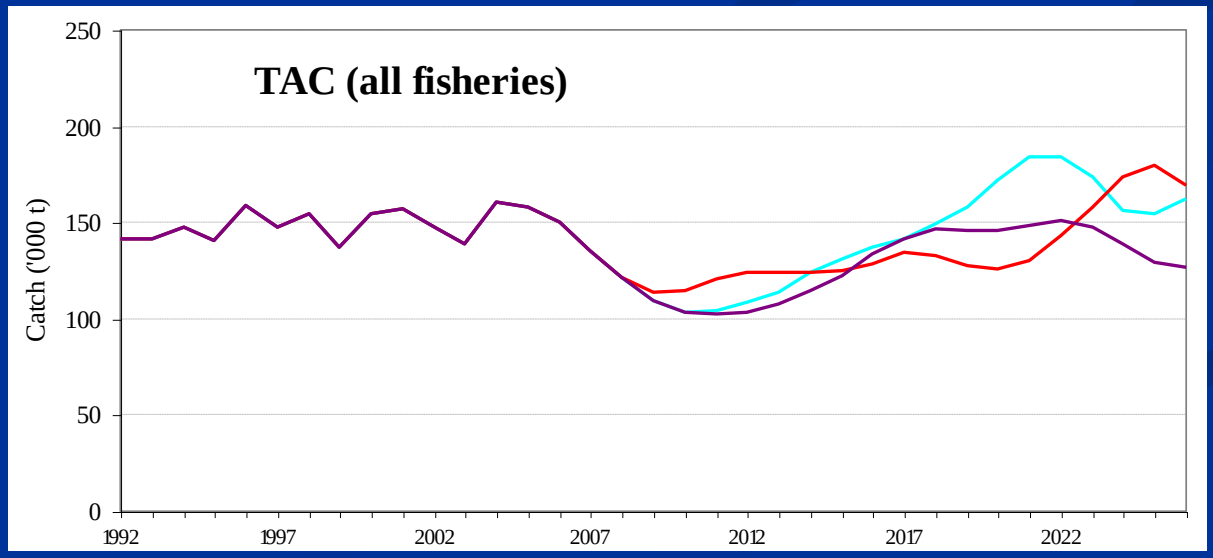

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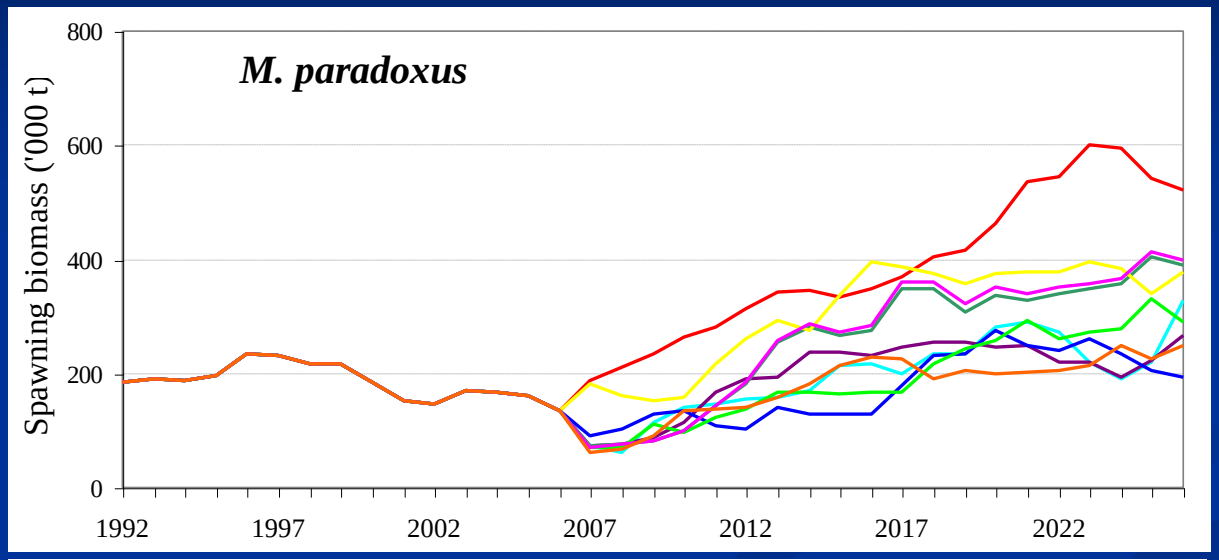

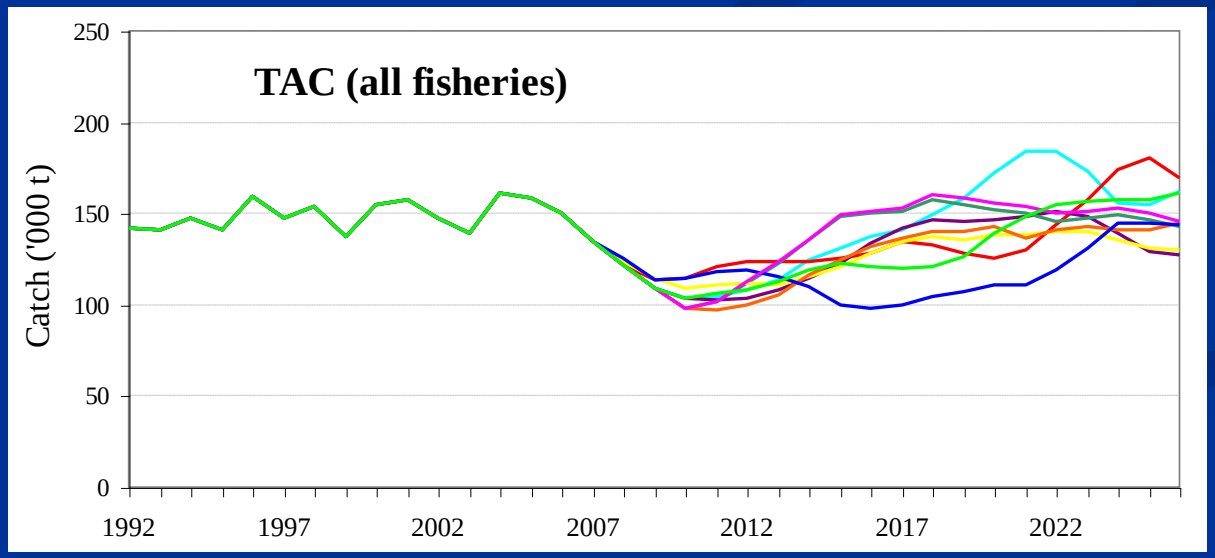

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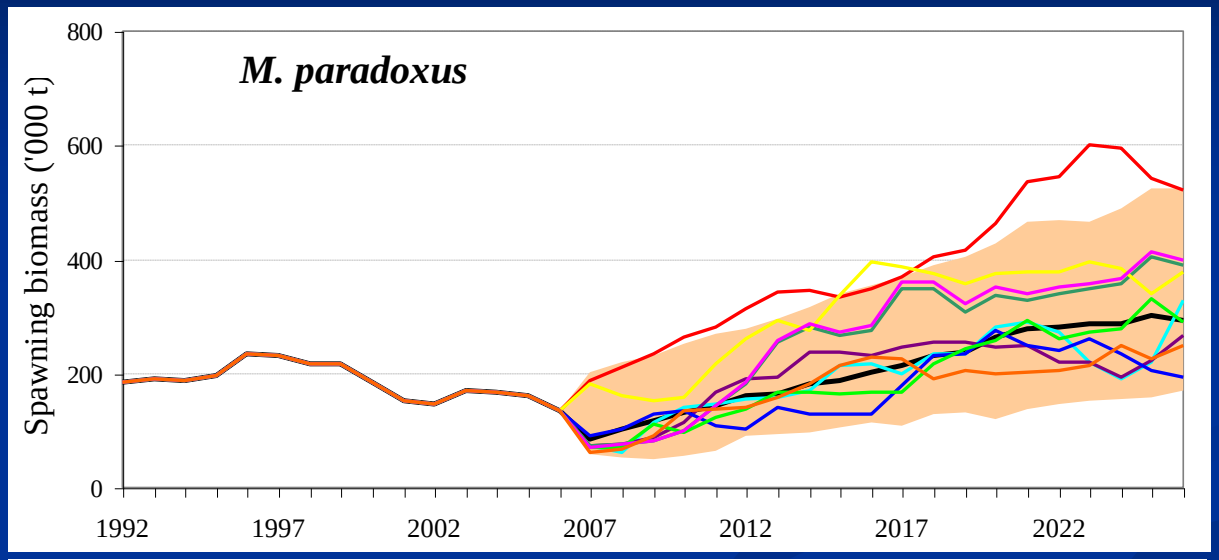

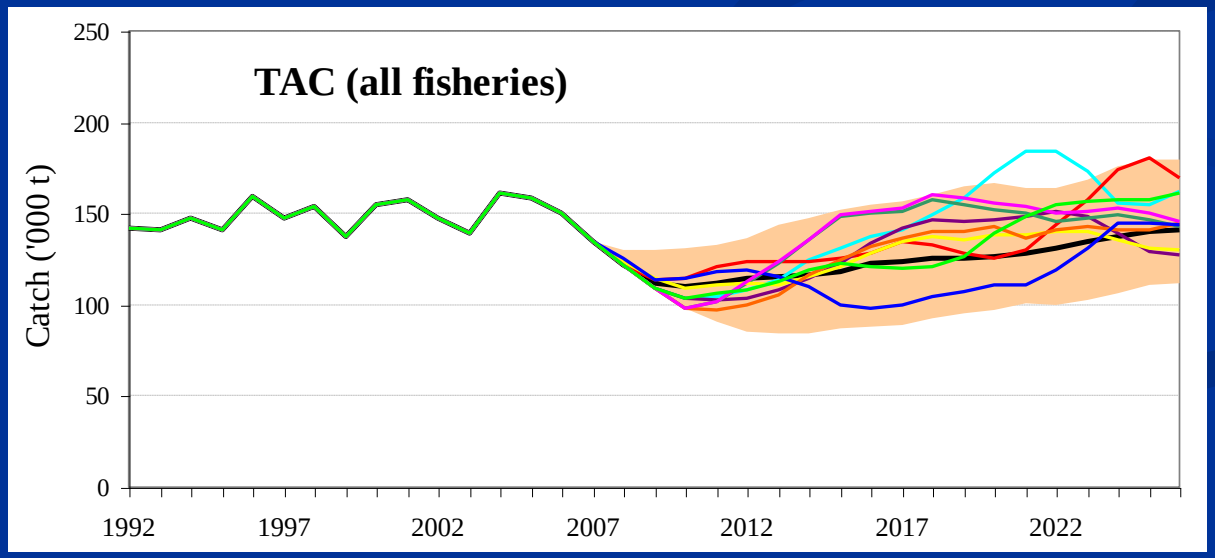

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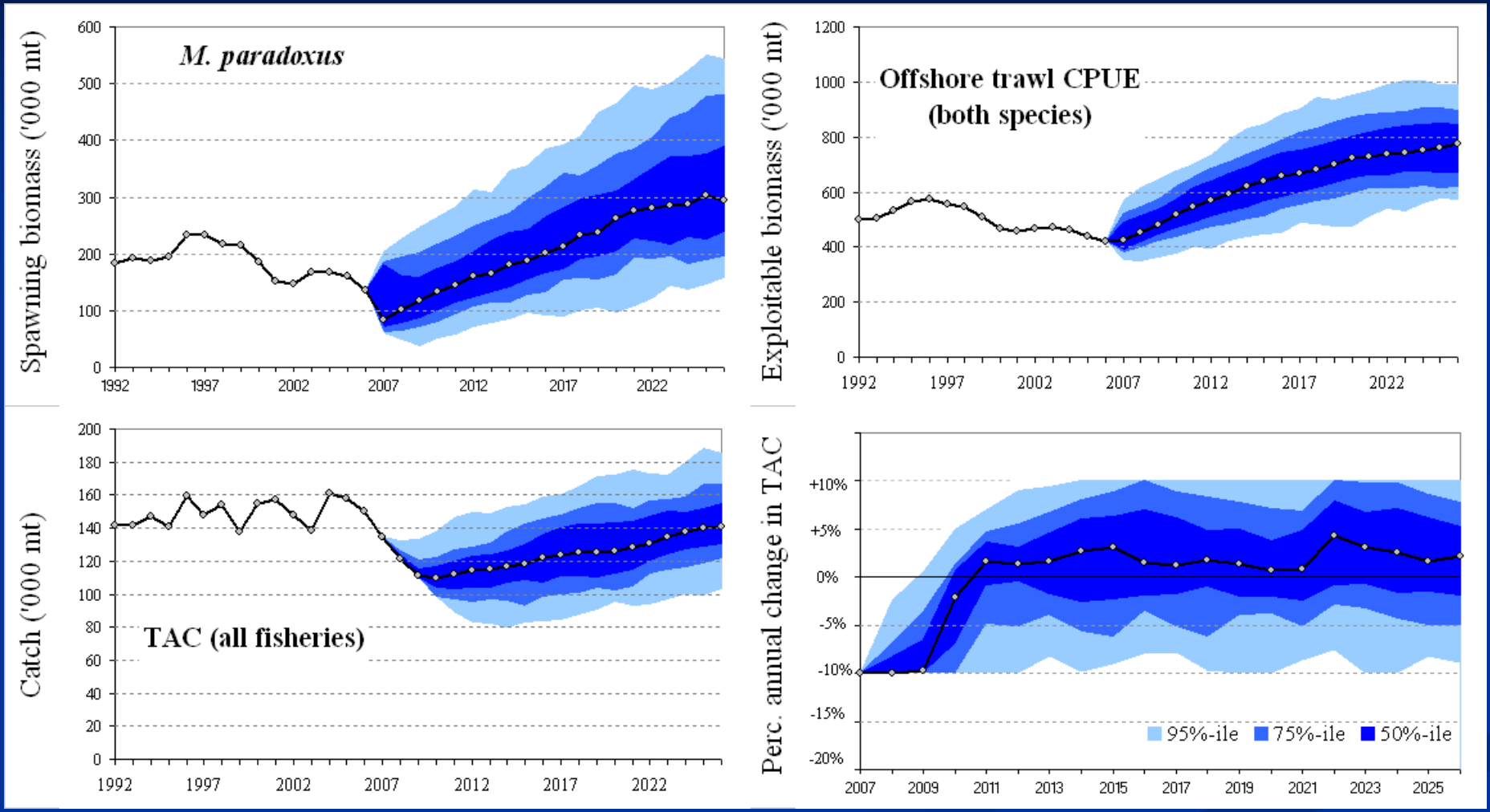
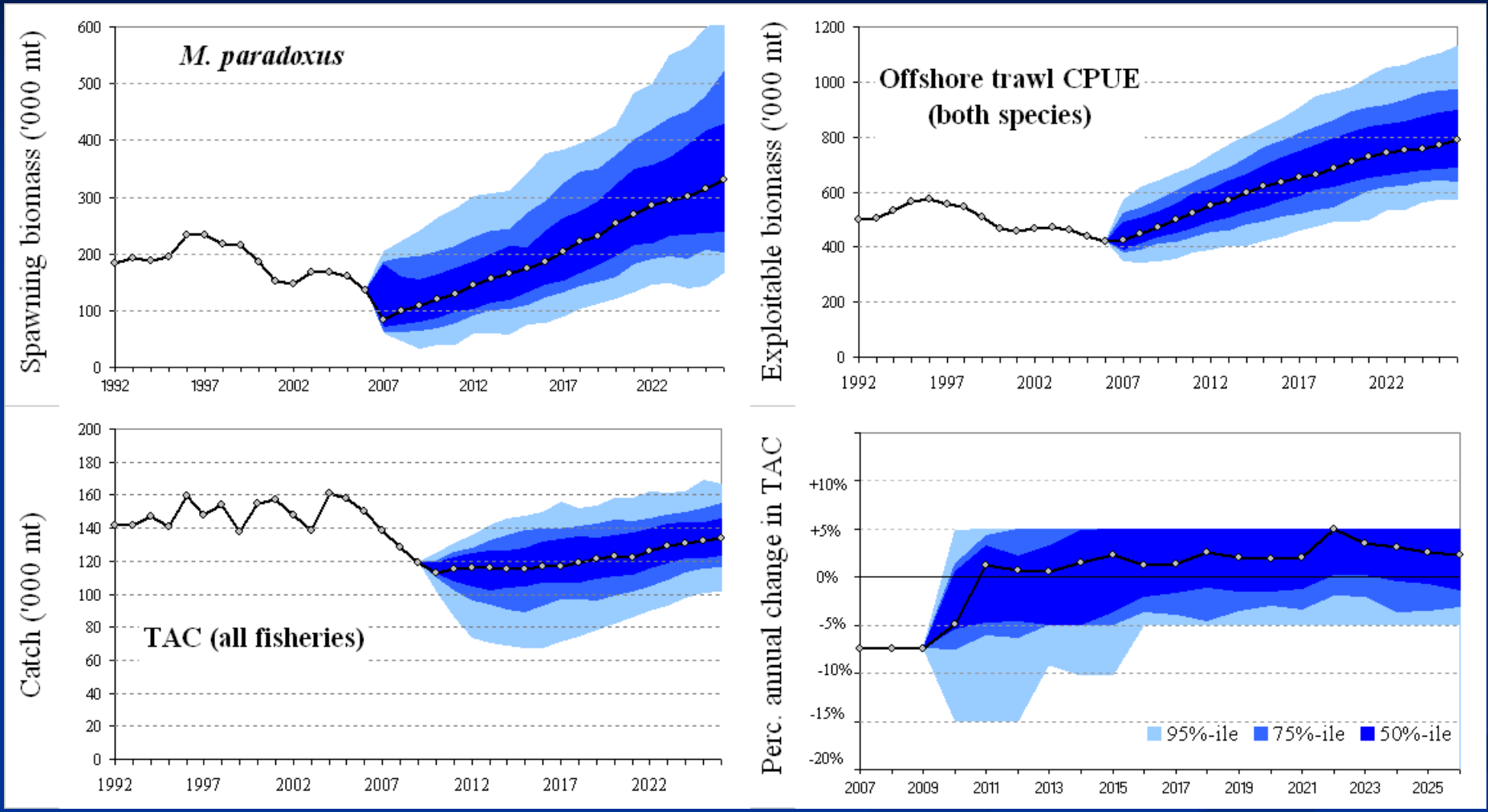

Spawning biomass ('000 mt)
M. paradoxus
600
500
400
300
200
100
0
1992
1997
2002
2007
2012
2017
2022
Exploitable biomass ('000 mt)
Offshore trawl CPUE
(both species)
1200
1000
800
600
400
200
0
Catch ('000 mt)
TAC (all fisheries)
200
180
160
140
120
100
80
60
40
20
Perc. annual change in TAC
+10%
+5%
0%
-5%
-10%
-15%
-20%
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
95%-ile
75%-ile
50%-ile

OMP2_21%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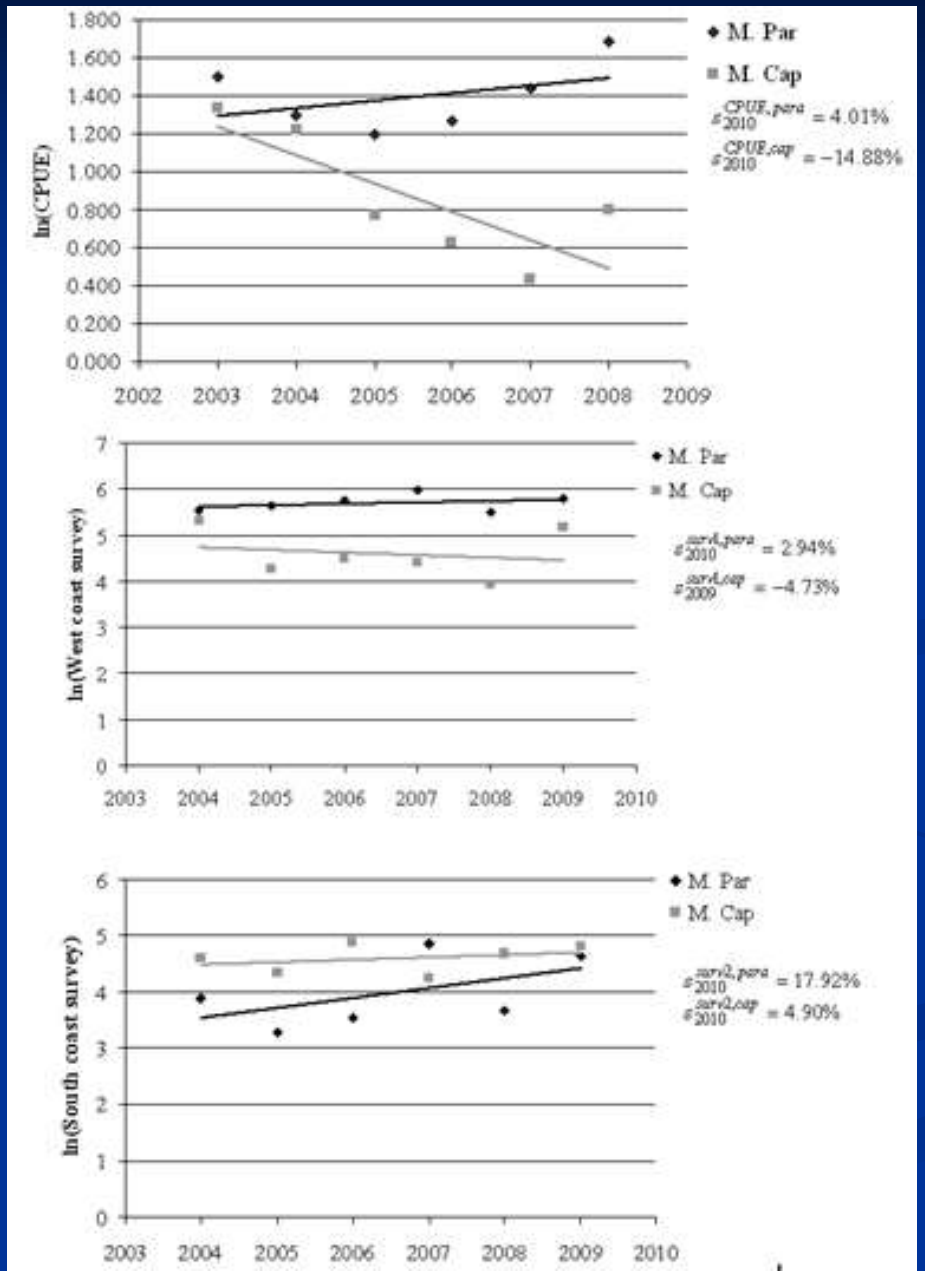
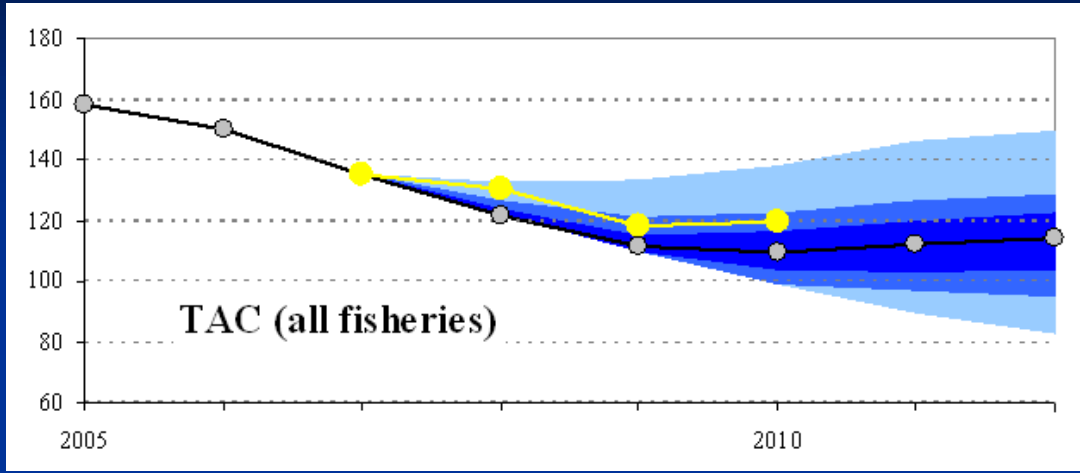
HAKE MP-2006 APPLICATION

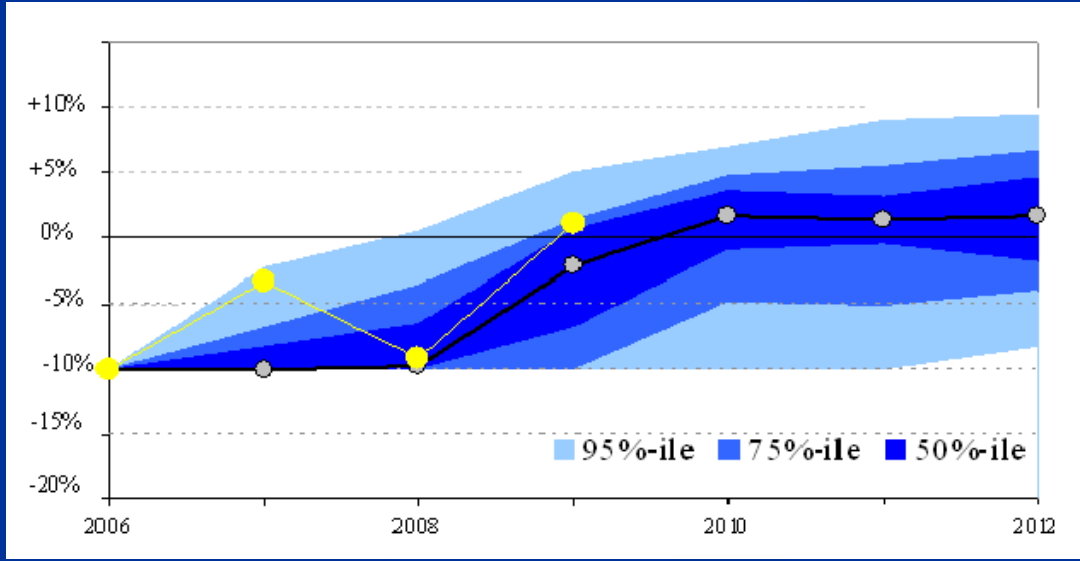


HAKE MP-2006 APPLICATION

Catch ('000 mt)

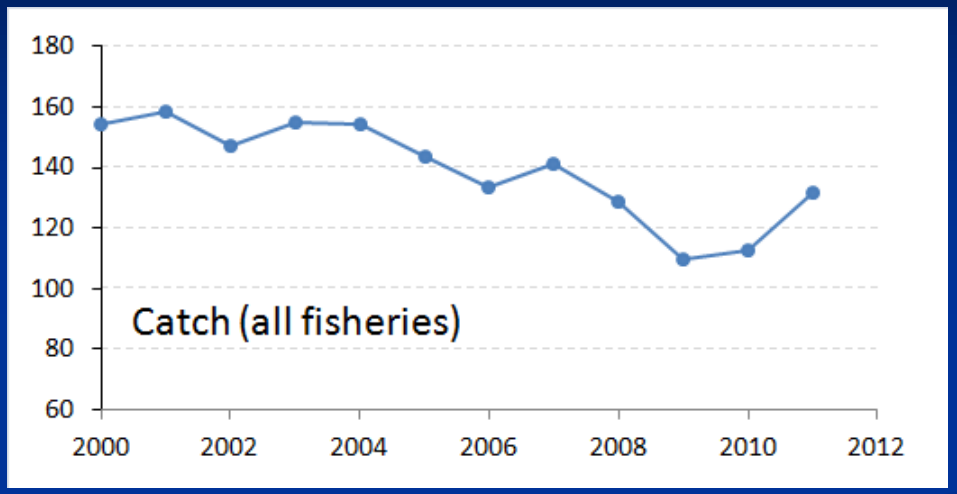


Perc. annual change in TAC

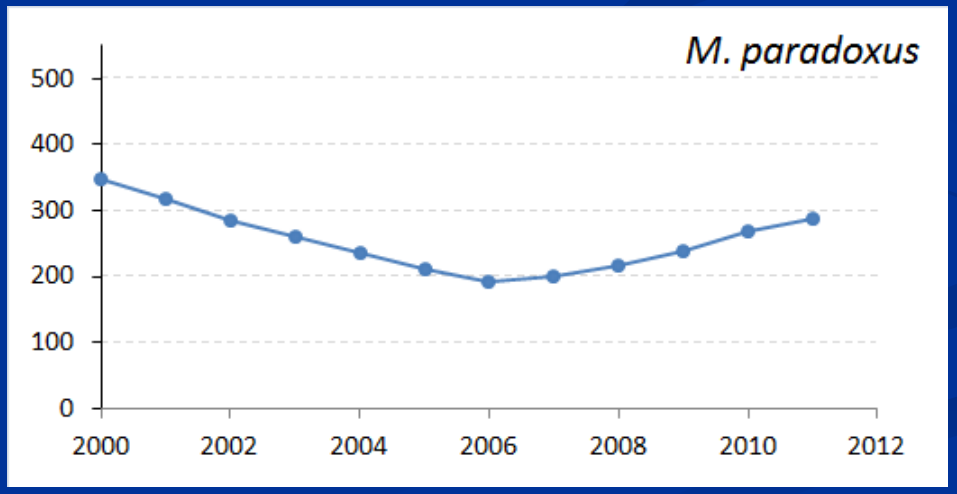


UPDATED ASSESSMENT

Catch ('000 mt)



M. paradoxus spawning biomass ('000mt)



IVb & c: OTHER EXAMPLES

b) North Sea sole

c) American Plaice

V. USA SETTING

POSITIVES AND HURDLES

POSITIVES

- Greater industrial stability

HURDLES

- Dropping maximum F constraints

Thank you for your attention

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