ON PRE-TESTING THE LIKELY EFFICACY OF SUGGESTED MANAGEMENT APPROACHES FOR DATA POOR FISHERIES

Doug S Butterworth, Susan J Johnston and Anabela Brandão

MARAM (Marine Resource Assessment and Management Group)
Department of Mathematics and Applied Mathematics
University of Cape Town, Rondebosch 7701, South Africa

BASIC MESSAGE

Expert judgment is not a sufficient basis for management

Need to:

i) Quantitatively link management responses to indicator values

ii) Know how likely such rules are to achieve fishery objectives

FRAMEWORK IS AVAILABLE TO DO THIS

Management Procedure (**MP**) approach [or **MSE**]

Could this be applied in data poor situations?

OUTLINE

- The traditional and MP approaches to fisheries management
- The MP approach: computation and structure
- Data poor example
  - * Contrasted to a data rich situation
- Dealing with conflicting data
  - * Example from a Patagonian toothfish fishery
- What's needed
  - To advance this approach for data poor situations

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 management measures (controls) for fisheries ?

a) Assess resource abundance, productivity

b) Apply e.g. HCR TAC recommendation

What particular difficulties arise with the traditional approach ?

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

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 (or other quantitative management measure) 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 ?

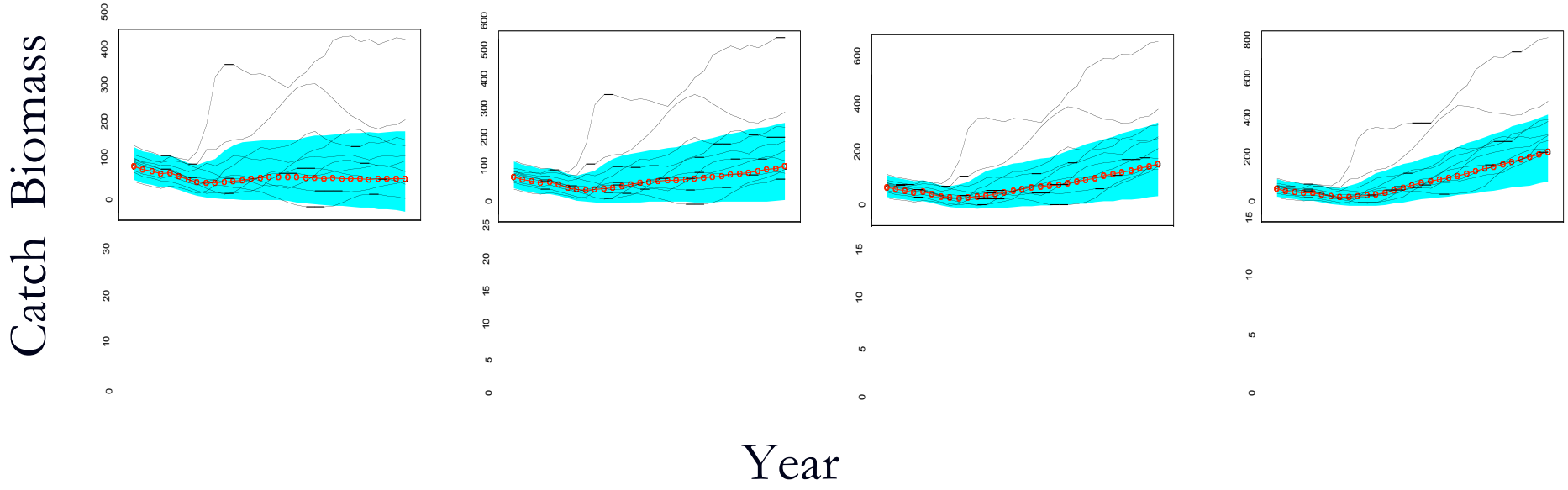
a) Compares simulated catch / risk / control (e.g. catch) variability trade-offs for alternatives

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

SOUTHERN BLUEFIN TUNA EXAMPLE

TRADE OFF

More catch ← → **More recovery**



Different MP 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 extent of variability of management measure (e.g. TAC)
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 ?

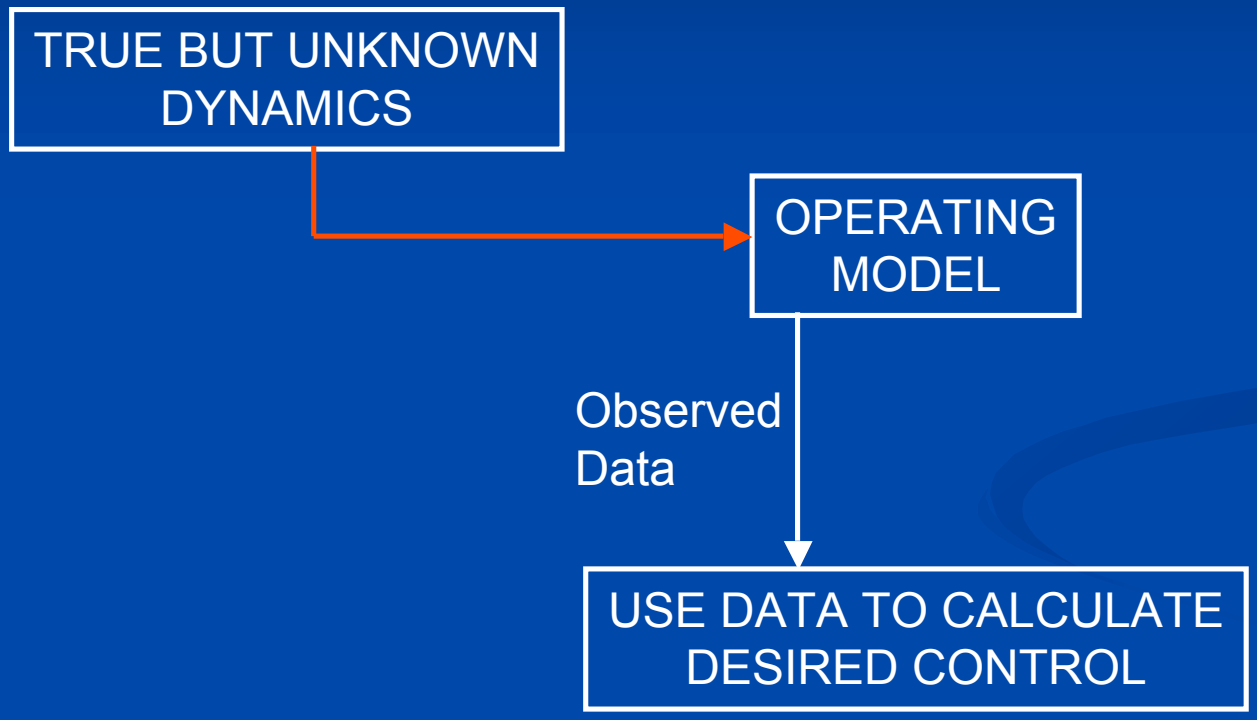
a) Lengthy evaluation time

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

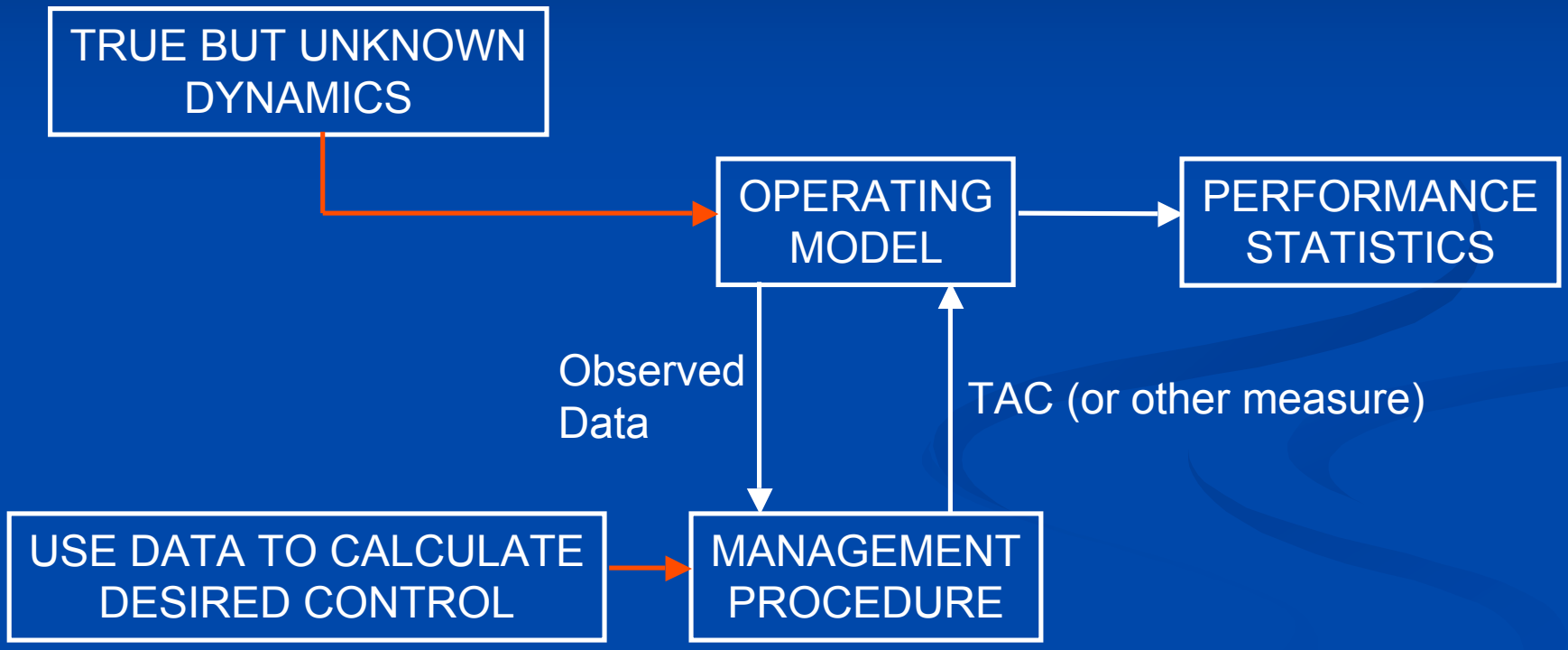
BUT

Provides default

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 control (e.g. **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 (possible underlying reality)

How it works

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

III. DATA POOR EXAMPLE.

FAIRLY TYPICAL CASE OF A DEPLETED RESOURCE

How should catches be adjusted to return to MSYL?

OPERATING MODEL

- Age structured production model
- Species of intermediate lifespan
- Realistic levels of recruitment and selectivity variation

DATA RICH/POOR CONTRAST

Data Rich: Catches and unbiased CPUE (CV=40%)

Data Poor: Mean length ℓ_{mean} (CV=8%)

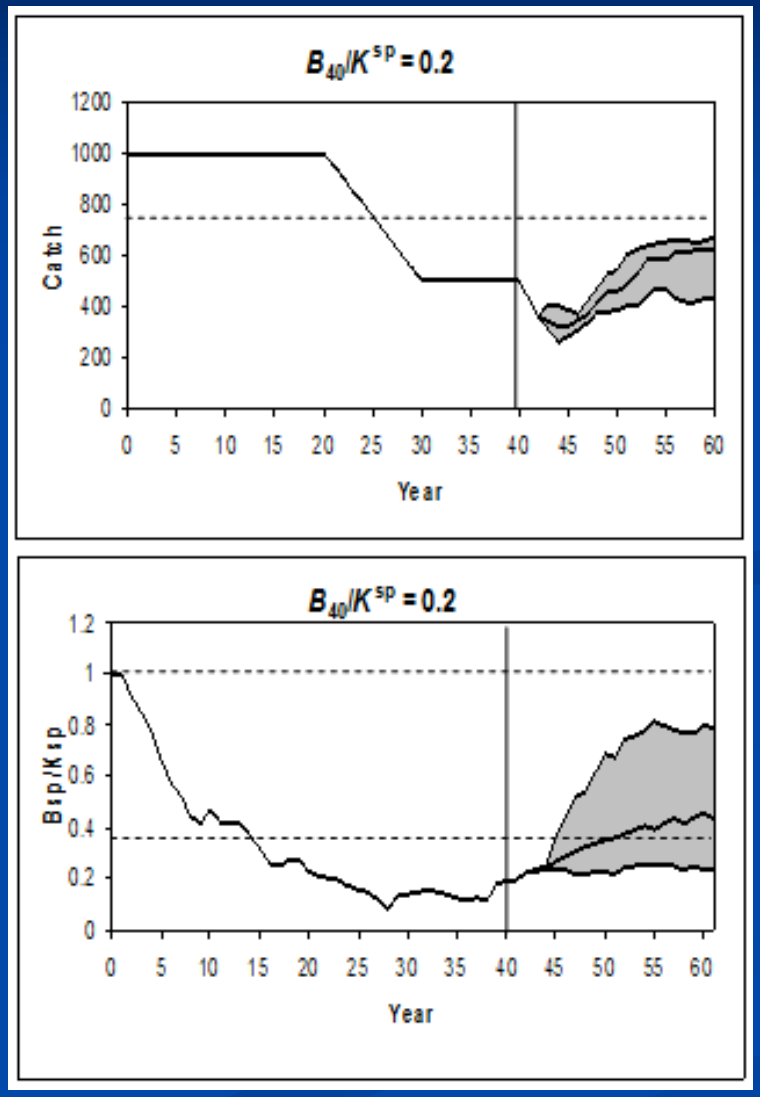
Data Rich MP: Production model; const F TAC

Data Poor MP: Empirical; "TAC" linear in ℓ_{mean}

Data Rich: Tune to 50% probability get to MSYL in 10 years

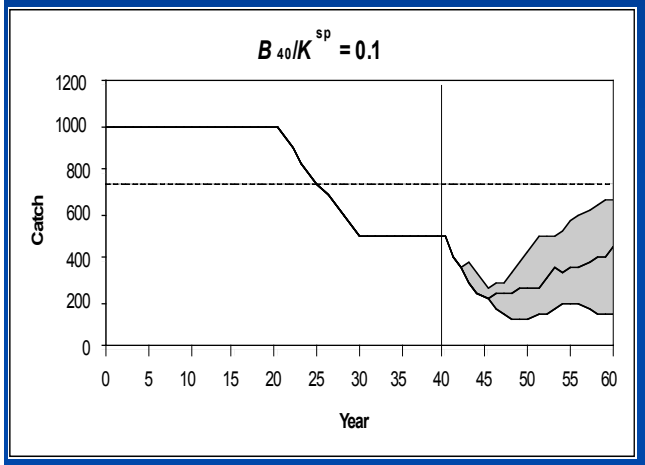
Data Poor: Tune to same depletion risk as Data Rich MP

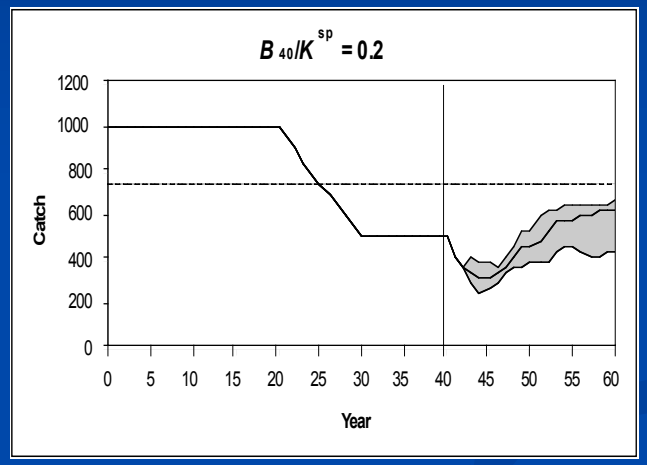
CPUE-BASED MP PERFORMANCE

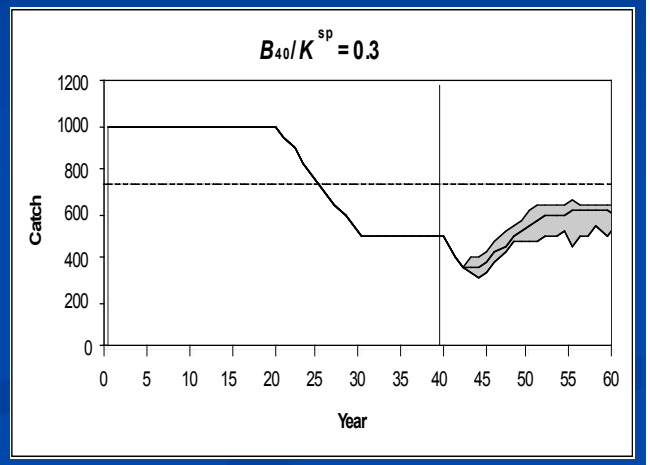


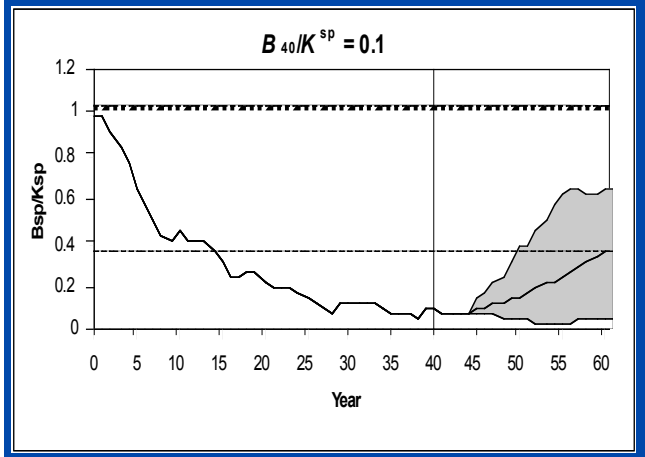
MSYL

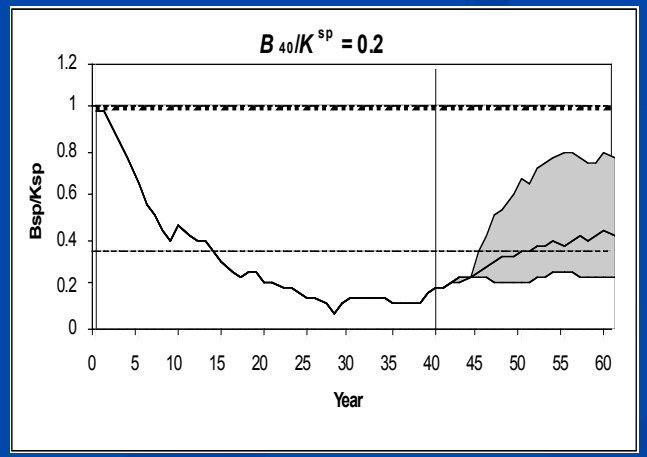
CPUE-BASED MP ROBUSTNESS

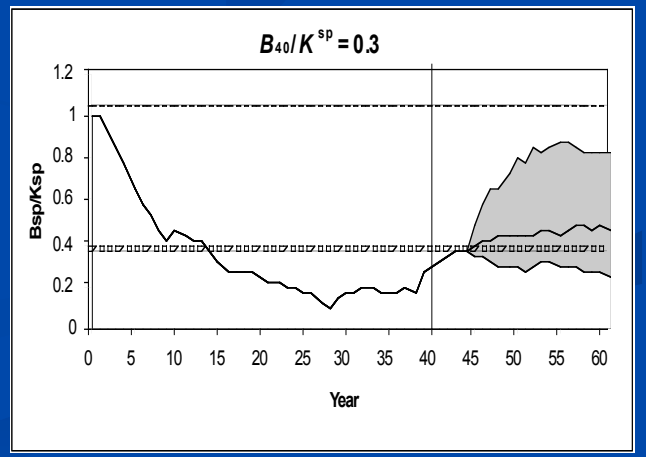




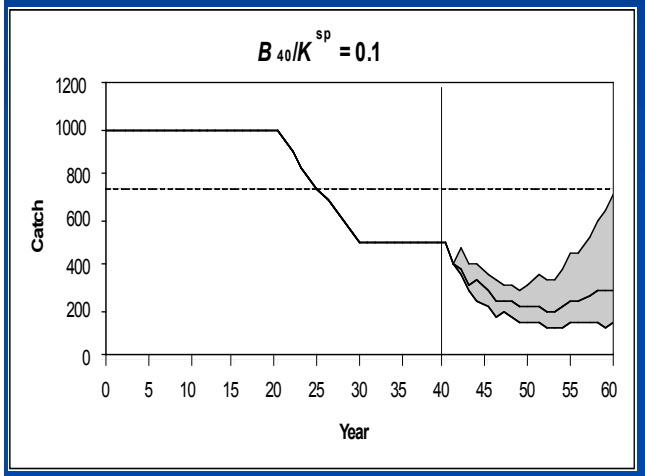


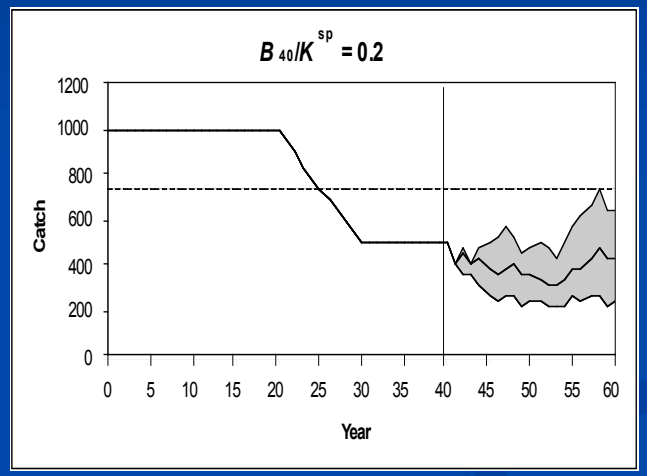


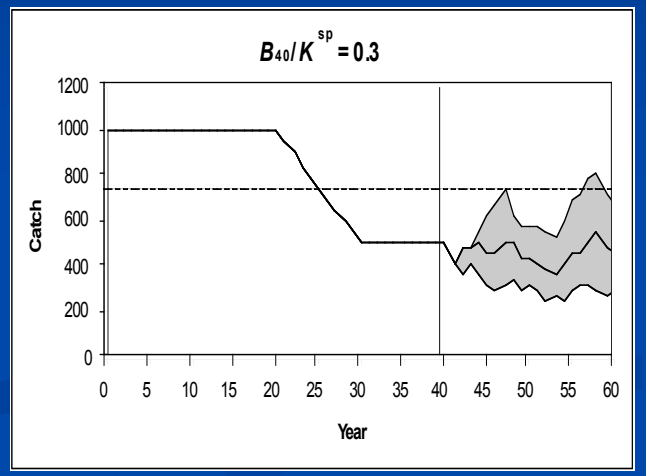


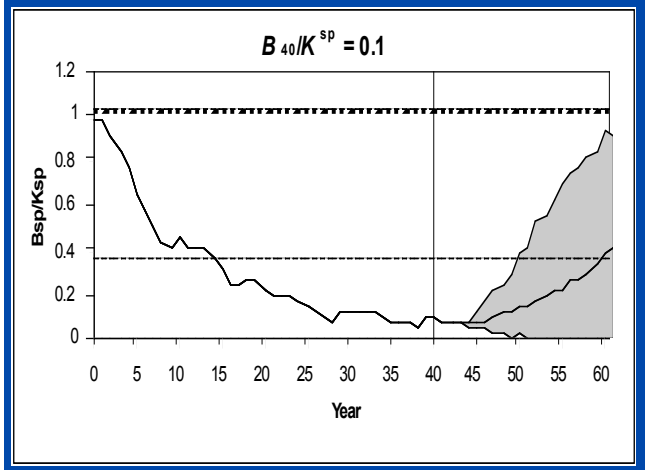


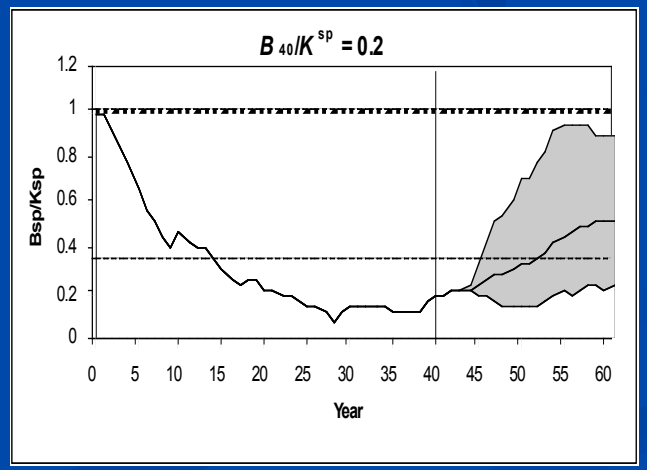
ℓ_{mean} -BASED MP ROBUSTNESS

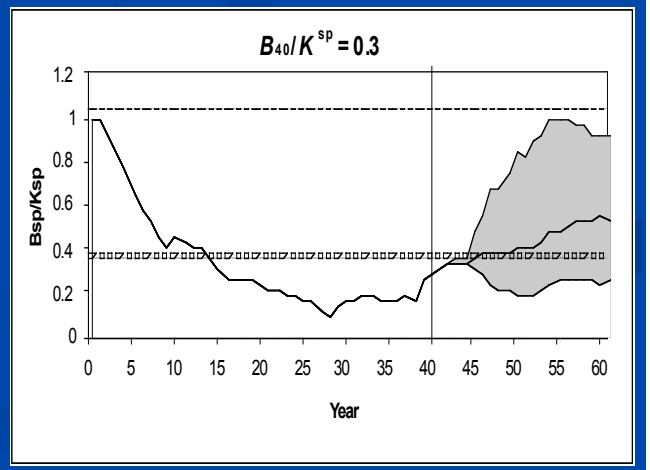












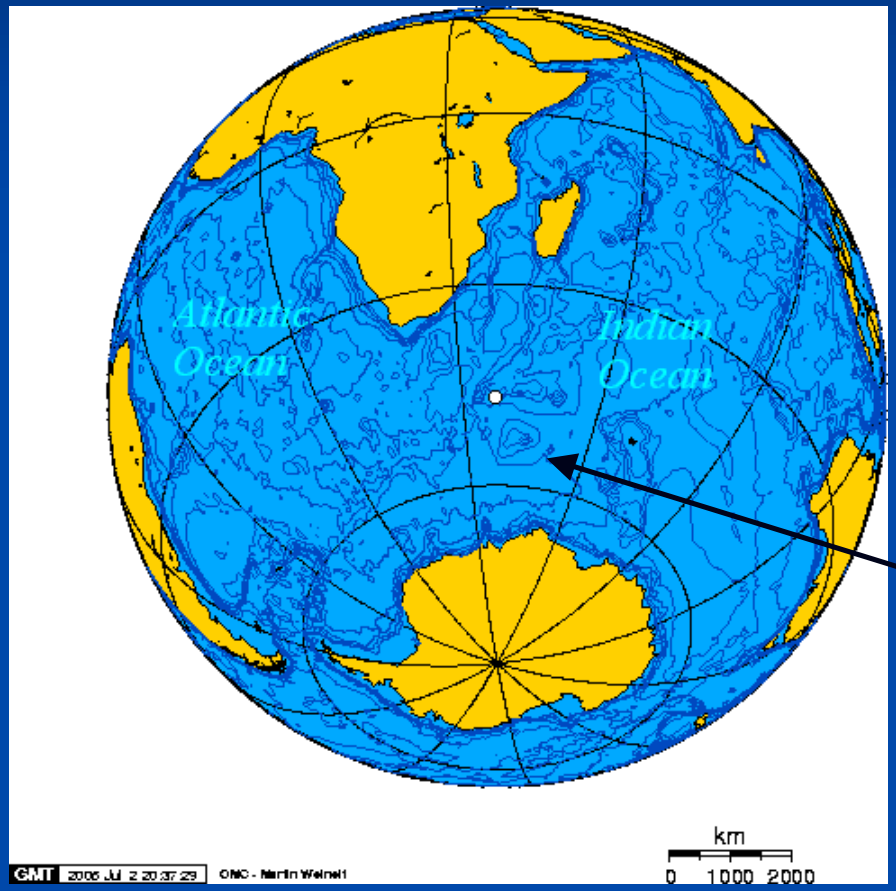
PERFORMANCES

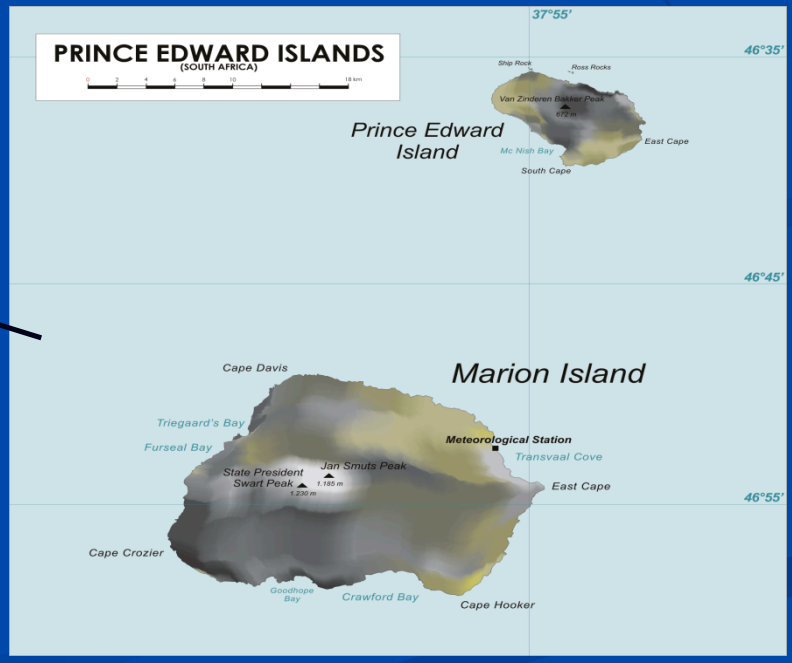
	CPUE MP	ℓ_{mean} MP
CATCH	447	400
B_{fin}/K	0.44	0.53
	[0.24; 0.79]	[0.24; 0.90]
AAV	8%	12%

DATA POOR MEANS PERFORMANCE LOSS

15% less catch; 50% more catch variability

IV. DEALING WITH CONFLICTING DATA.





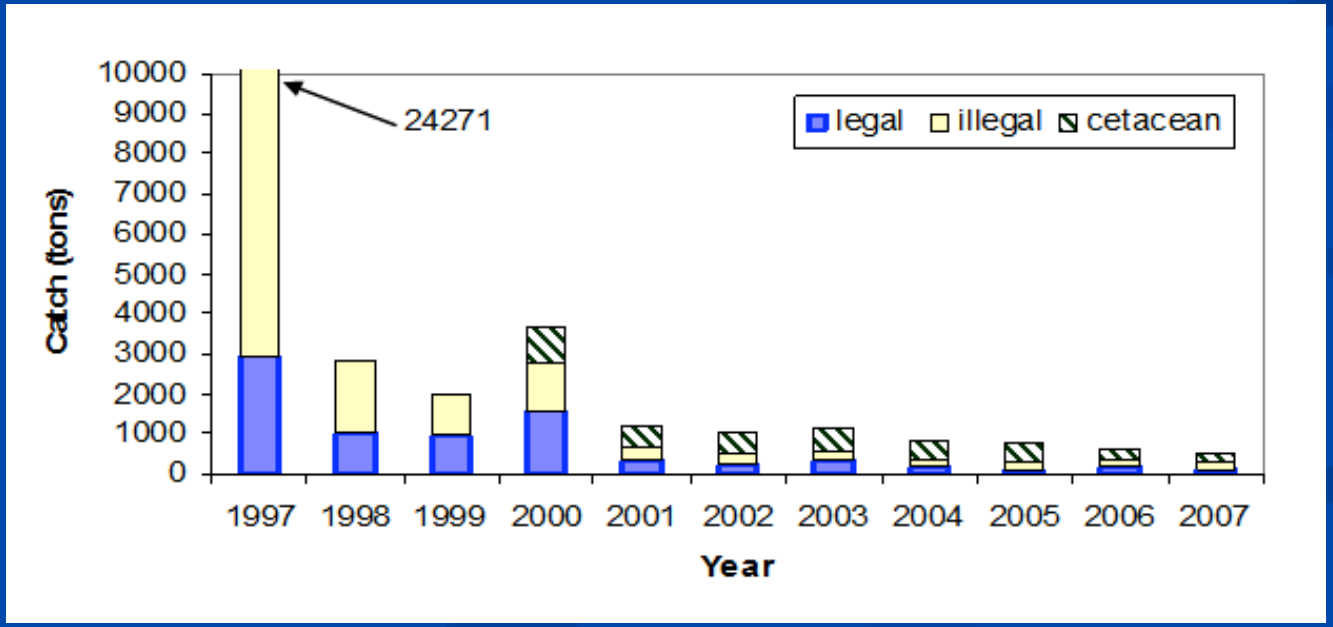
Prince Edward Islands Patagonian toothfish

INFORMATION-POOR DATA

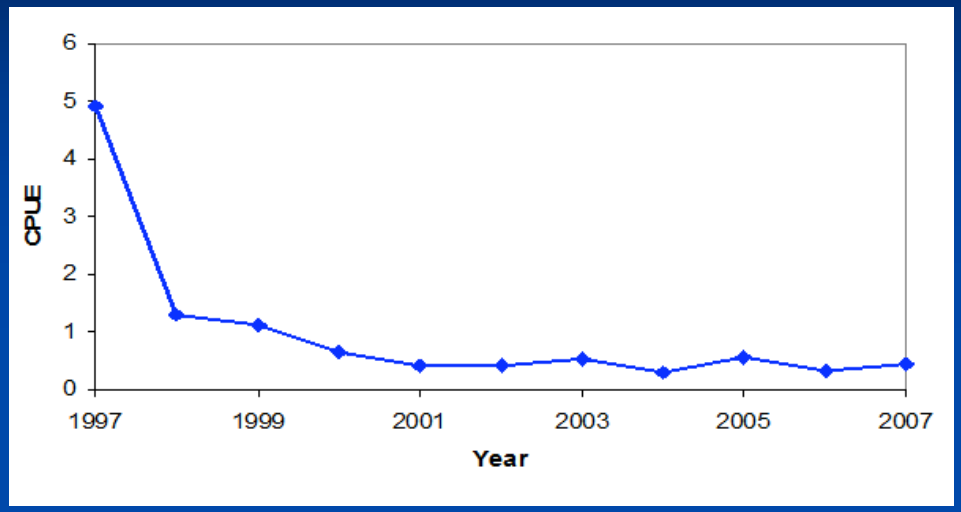
Longline CPUE

Some longline length distribution data

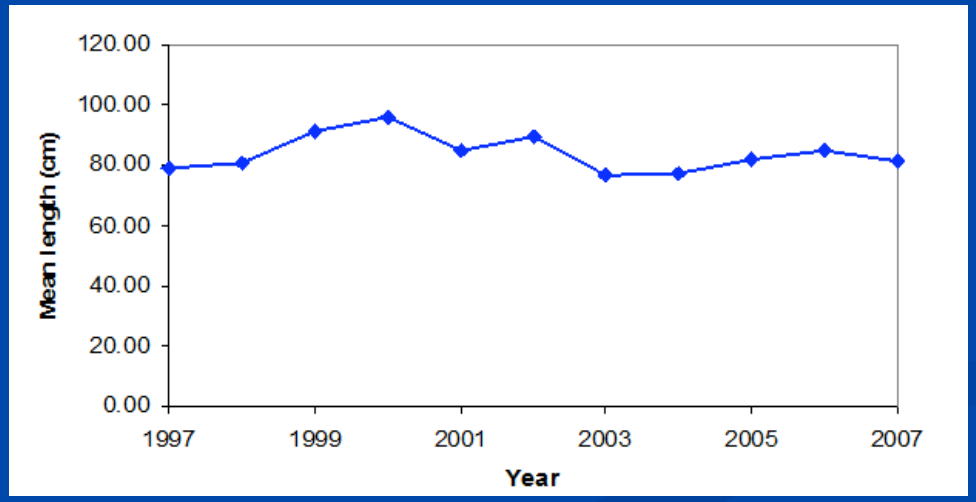
Large poorly known illegal catches



CONFLICTING CPUE AND LENGTH DATA



HEAVILY DEPLETED



LITTLE IMPACTED

UNCERTAINTY RE CURRENT STATUS

High weight to length: Above MSYL
High weight to CPUE: Below MSYL

ALTERNATIVE OPERATING MODELS

- Need sensible and consistent basis to generate future observation errors
- Future: both data sets reliable
- Past: different portions of data unreliable

Feedback properties of MP distinguish hypotheses

CONTROL RULE DESIGN PROBLEMS

Decreasing CPUE is:

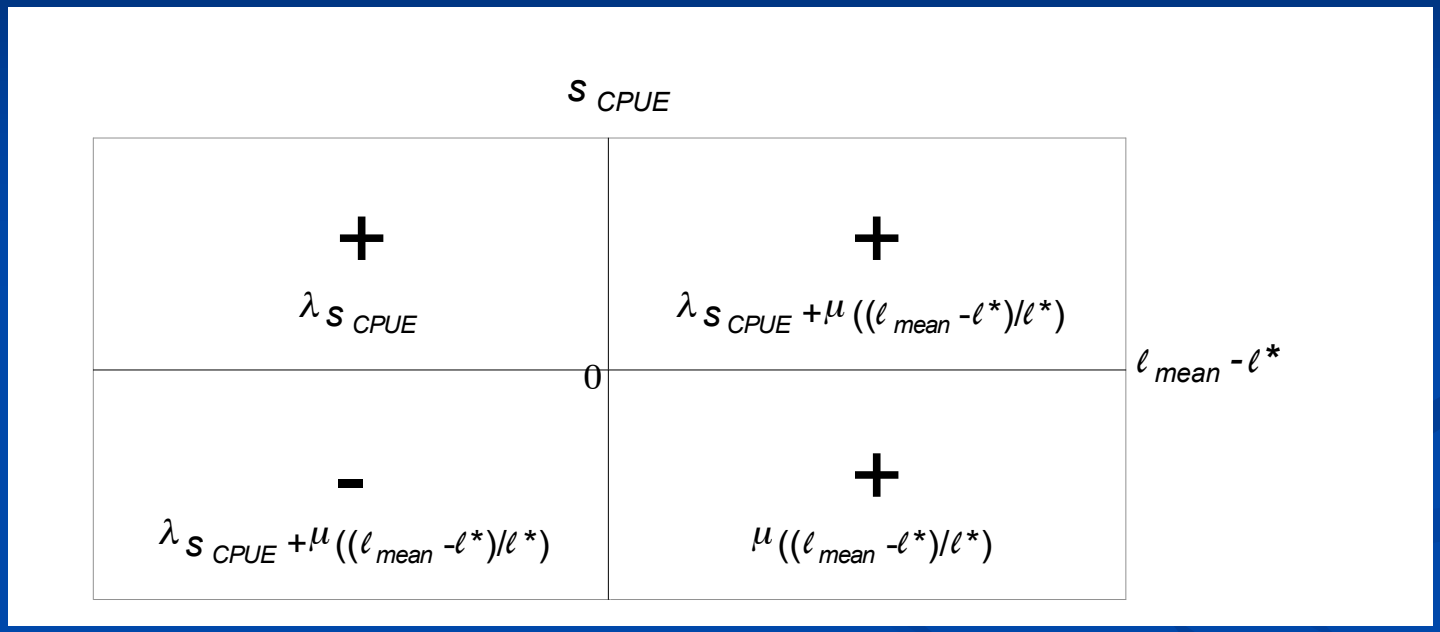
Problematic if below MSYL

Probably OK if above MSYL

SOLUTION

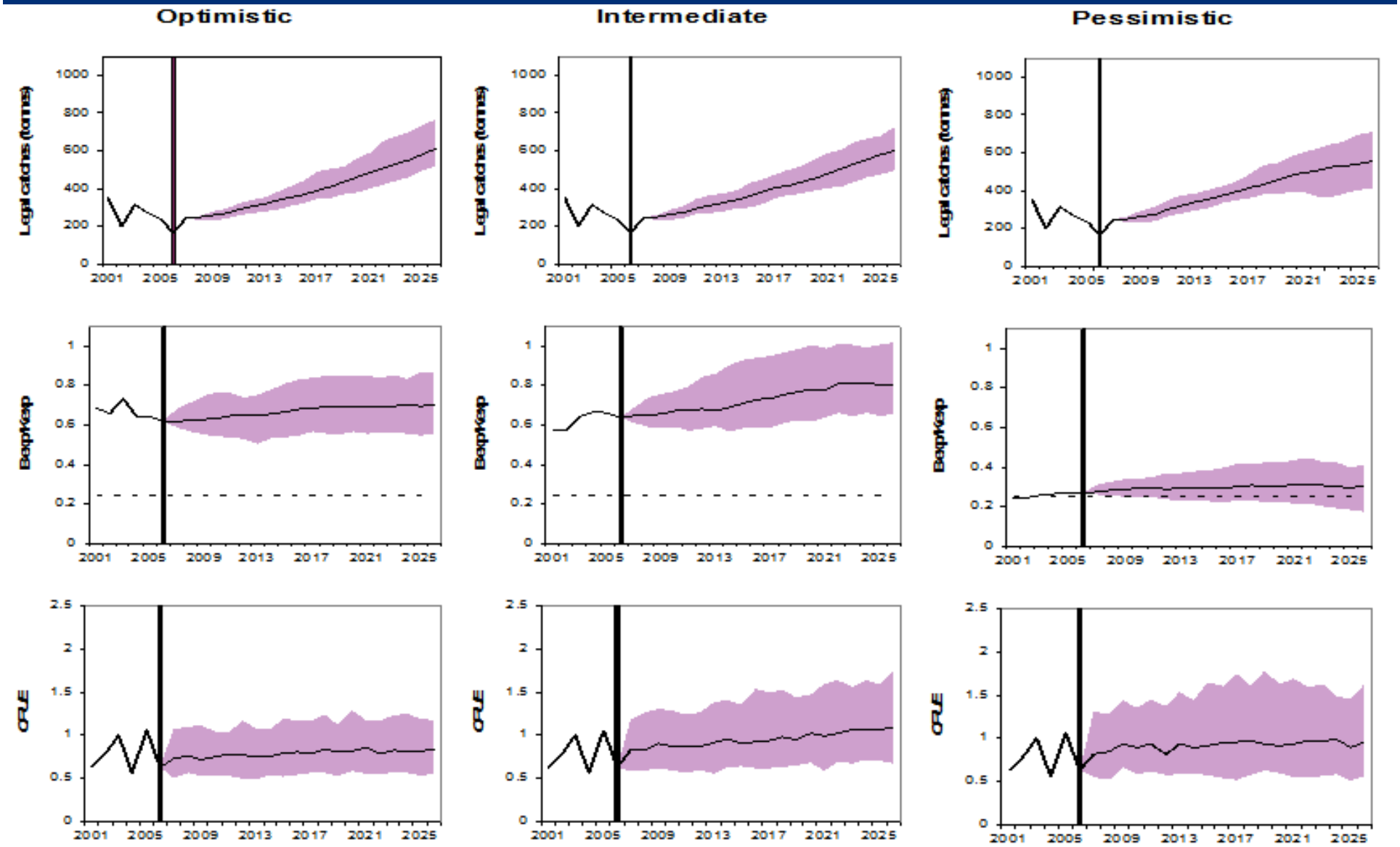
Compare ℓ_{mean} with pre-specified ℓ^* (which serves as MSYL proxy)

CONTROL RULE



TAC increased or decreased dependent of slope of CPUE s and mean length of catch ℓ_{mean}

ANTICIPATED PERFORMANCE



RESULTS

ACROSS A WIDE RANGE FOR CURRENT STATUS:

- **No depletion risk**
- **Increase in catch over time**

BUT

- **Under-utilisation if above MSYL**

V. WHAT'S NEEDED?

FOR DATA POOR FIRST PRIORITY IS GENERIC MPs

NEED GENERIC OPERATING MODELS FOR TESTING

- **Structure: ASPM + allometry**
- **Stock-recruit steepness and variability: From Myers' database**
- **?? Observation error variance for indices typical available ??**

NEED FOR A MYERS'-TYPE SURVEY

[Multi-species: "Too-hard" box for now]

Thank you for your attention

Acknowledgements for assistance with presentation preparation to Michelle De Decker