MORE ON MSE AND MANAGEMENT PROCEDURES

Doug S Butterworth

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

OUTLINE

I. Best-assessment-based management and its difficulties

II. Management Procedures (MSE) and feedback

III. How precautionary? – consistency problems

IV. Scientists – key problems

V. Looking ahead

I. BEST-ASSESSMENT-BASED MANAGEMENT

E.g. US Magnuson-Stevens Act with its MSY-related recovery targets

"Best Assessment" of resource

Catch control law

→ TAC
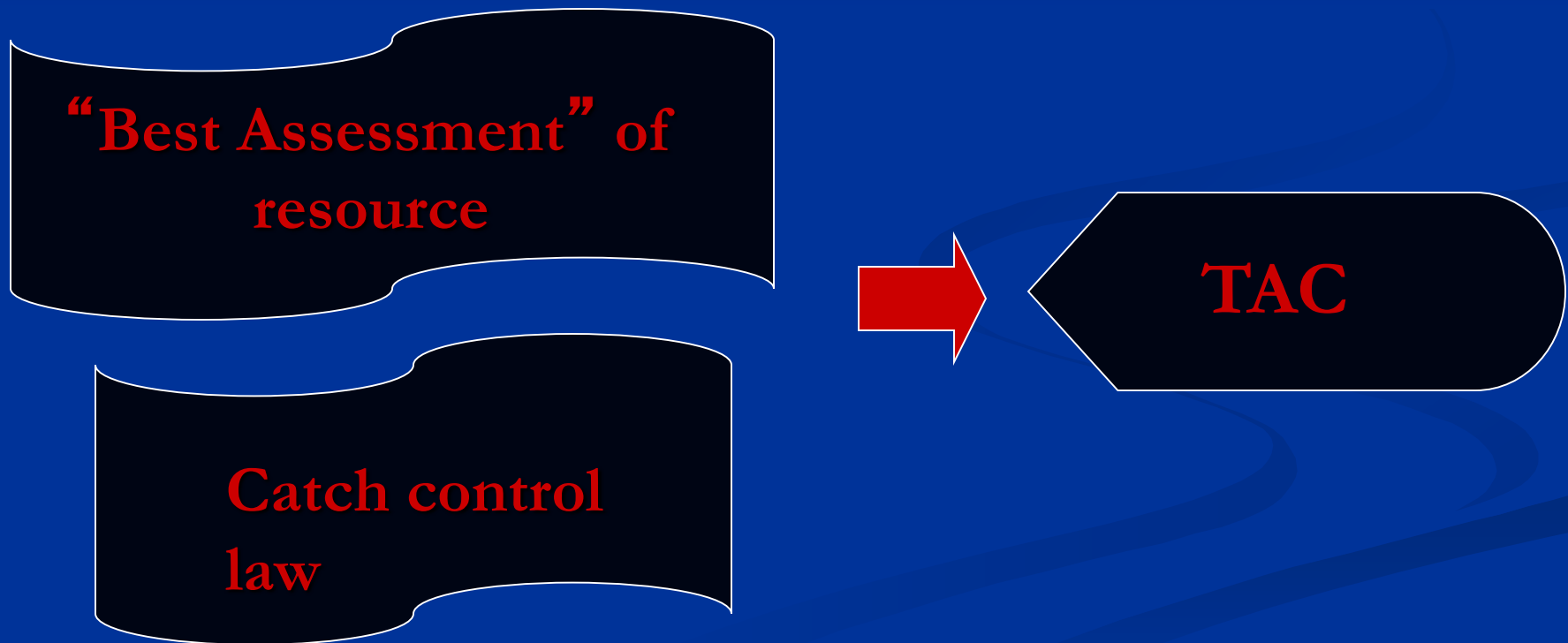
DIFFICULTIES FOR THE BEST-ASSESSMENT-BASED APPROACH

- Inter-annual best assessment/TAC variation (including MSY-related Reference points)

- No consideration of longer term trade-offs (which requires taking account of management responses to future resource monitoring data)

- Lengthy haggling

- What if the "best assessment" is wrong?

- Default decision of "no change"

IWC NEW MANAGEMENT PROCEDURE (NMP) 1976
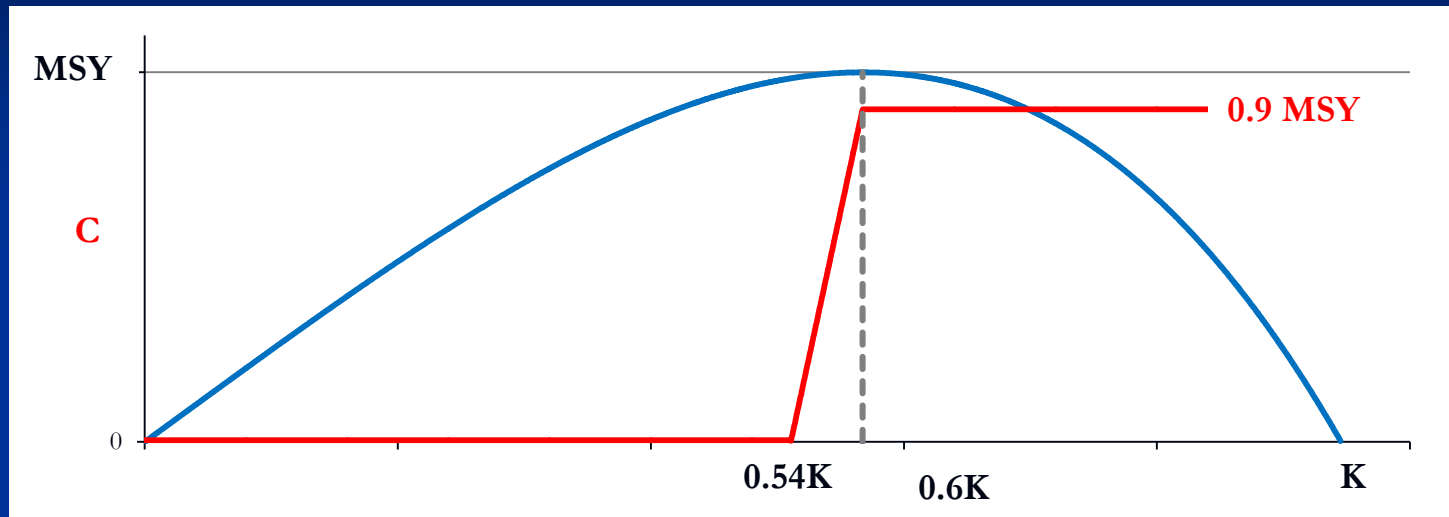
Harvest Control Rule:

$C = 0$ for $P < 0.54\,K$

$C = 0.9\,MSY$ for $P > 0.60\,K$

Input required to calculate C:

P: current abundance

K: pristine abundance

MSY

1980s: FAILURE OF THE NMP

- **How to calculate P, K and MSY?**
- **How to take uncertainties into account?**

Walter Zucchini

"Don't parametrise the world if you can't estimate the parameters"

Must be able to operationalise any management approach

IWC SOLUTION:

Move to a "management procedure approach"

KEY DIFFICULTIES FOR IWC NMP

- Inter-annual best assessment/TAC variation (including MSY-related Reference points)
- What if the "best assessment" is wrong?

DITTO US MAGNUSON-STEVENS ACT

Why has the IWC lesson still not been learnt three decades later?

II. MANAGEMENT PROCEDURES (MSE)

WHAT NEW DO THEY BRING TO ASSIST SOLVE THE PROBLEM?

FEEDBACK CONTROL!

Monitor stock changes and adjust management measures (e.g. TACs) accordingly

THE MANAGEMENT PROCEDURE APPROACH (MSE)

1) Specify alternative plausible models of resource and fishery (Operating Models – OMs)

2) Condition OMs on data (effectively alternative assessments); pre-specify future data inputs to MP

3) Agree performance measures to quantify the extent to which objectives are attained

4) Select amongst candidate MPs for the one showing the "best" trade-offs in performance measures across objectives and different OMs in simulation testing

ADVANTAGES OF THE MP APPROACH

- Less time haggling to little long-term benefit
- Proper evaluation of risk
- Sound basis to justify limiting inter-annual TAC changes
- Consistency with Precautionary Approach
- Framework for interaction with stakeholders
- Better use made of haggling time saved
- Provides a default

PROBLEMS WITH THE MP APPROACH, AND HOW TO SOLVE THEM

- Lengthy development time
- Overly rigid framework
- Trusting to an auto-pilot?
- Input data poor or missing
- Reference case/set selection

IN SUMMARY

- **The MP approach can solve most, though not all, of the problems of the Traditional "best assessment + control rule" approach**

- **It does introduce some other difficulties, but these can be resolved by operating within a sound framework (e.g. regular reviews, exclusion of "back-tracking" within the MP development process)**

- **Its greatest advantages are probably:**

  - **A sound basis to limit the extent of future TAC variations without compromising resource status**

  - **Properly addressing concerns about scientific uncertainty through simulation testing to ensure that feedback secures reasonably robust performance across a range of plausible alternative resource dynamics**

MPs: THE DIFFICULT
(Assessment-based-management)
MADE EASY?

How well could simple management procedures have performed if applied to some North Atlantic stocks 20 years ago?

Develop MPs based on what was known in 1990, and see how they would have worked

(Helena Geromont)

THE SIMPLE MPs

APPLIED TO ONE ABUNDANCE INDEX

[**Constant catch:** For comparison]

Slope: TAC increased or decreased in proportion to recent abundance index (e.g. survey) trend

Target: TAC increased or decreased in proportion to the extent by which the abundance index exceeds or falls below a target index level

NOTE FEEDBACK NATURE

SIMPLE MPs

Constant catch MP: $\quad TAC_{y+1} = TAC^{t\arg et}$

Slope MP: $\quad TAC_{y+1} = TAC_y(1 + / s_y)$

Target MP: $\quad TAC_{y+1} = TAC^{t\arg et}\left[w + (1 - w)\left(\dfrac{I_y^{recent} - I^0}{I^{t\arg et} - I^0} \right) \right]$

(I = index of abundance available annually)

DATA: SURVEY INDEX

North Sea Sole (Subarea IV)
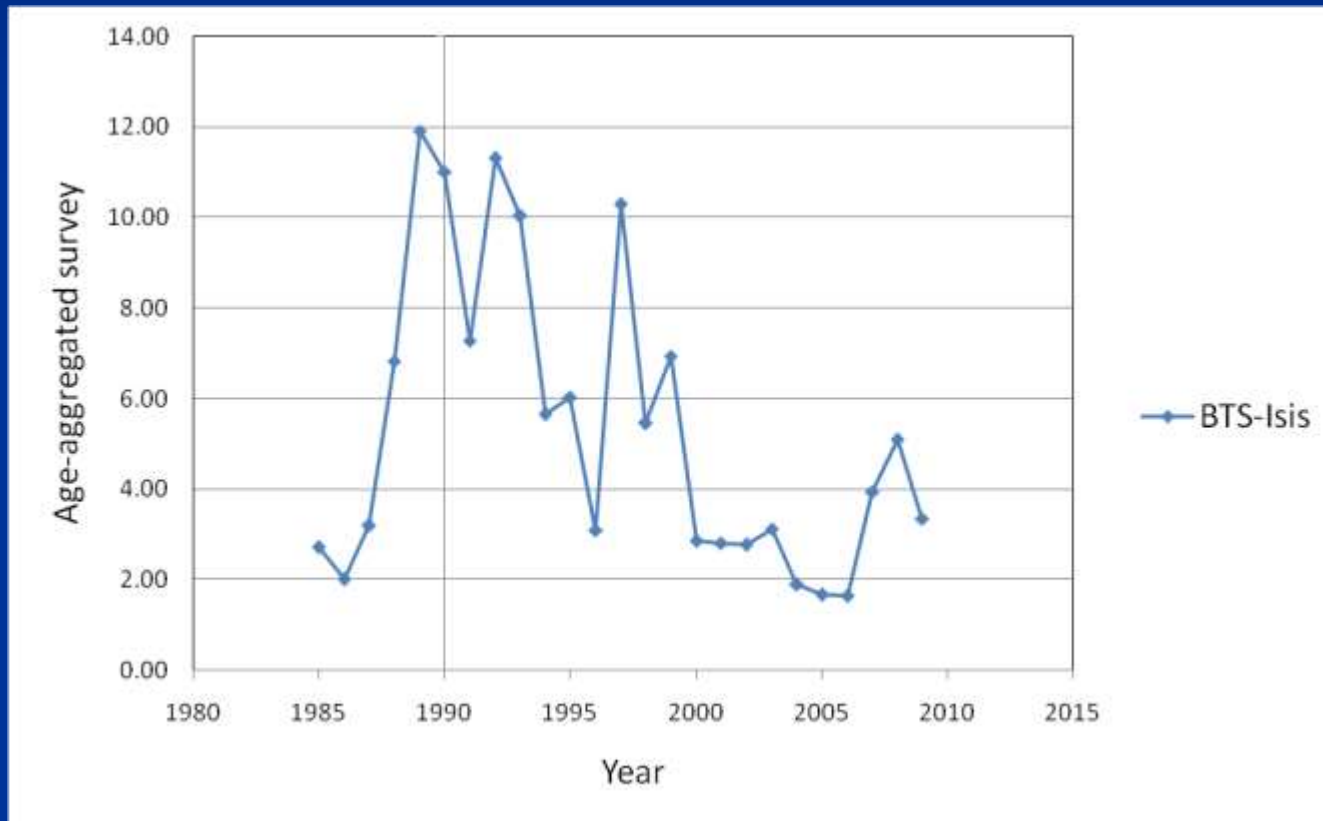
PROJECTIONS UNDER UNCERTAINTY IN 1990
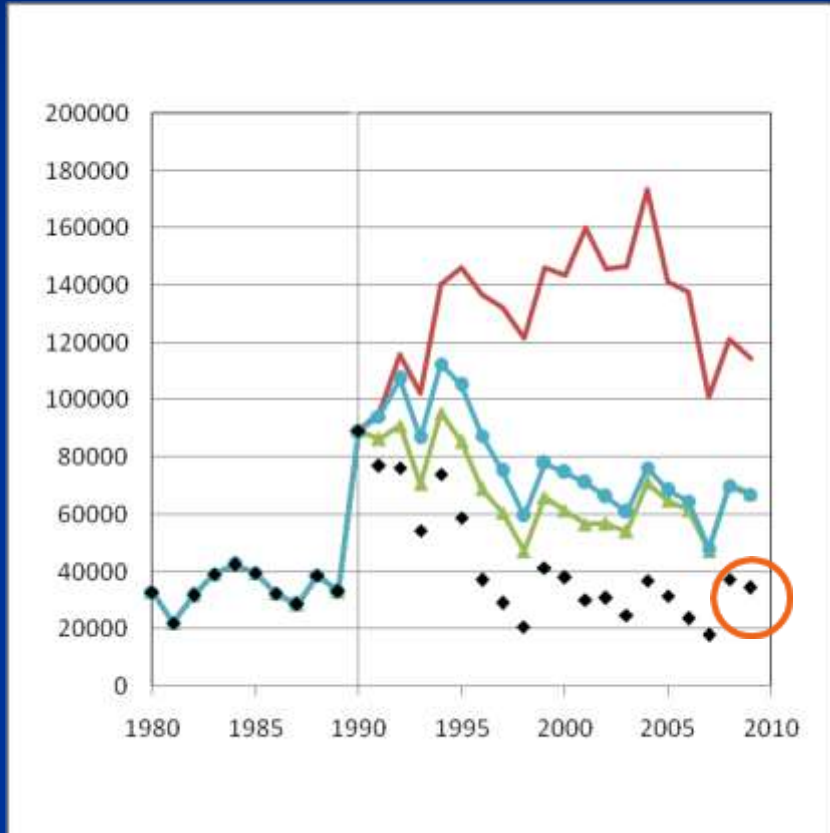
North Sea Sole (Subarea IV)

Target MP:
95% PI - - -
Median ——
Actual ◆
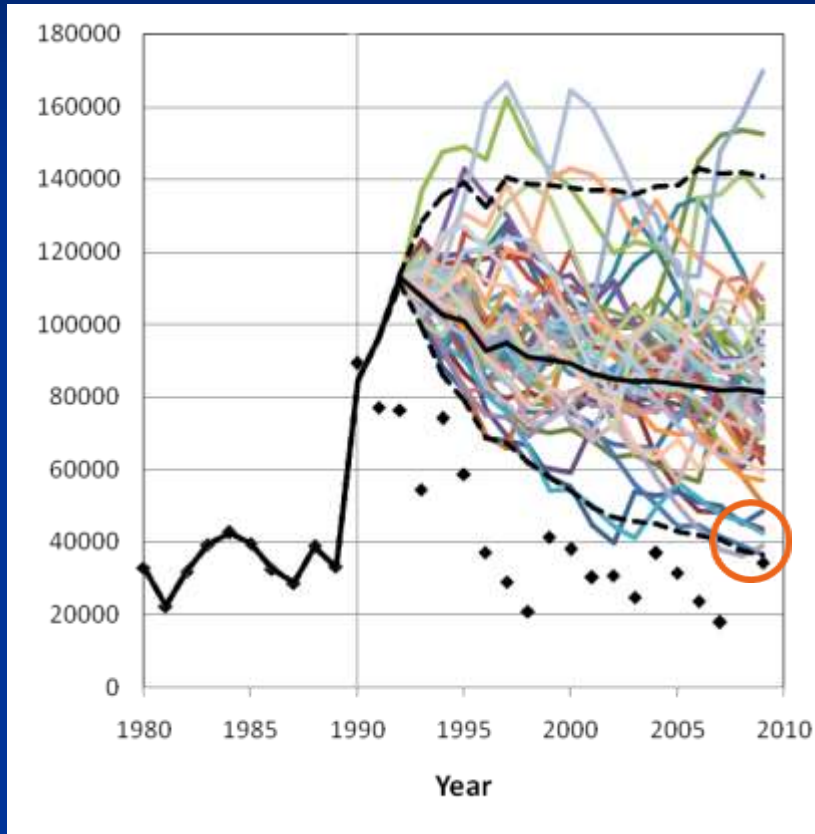
Spawning biomass (tons)   Annual catch (tons)

WHAT WOULD HAVE HAPPENED

North Sea Sole (Subarea IV)
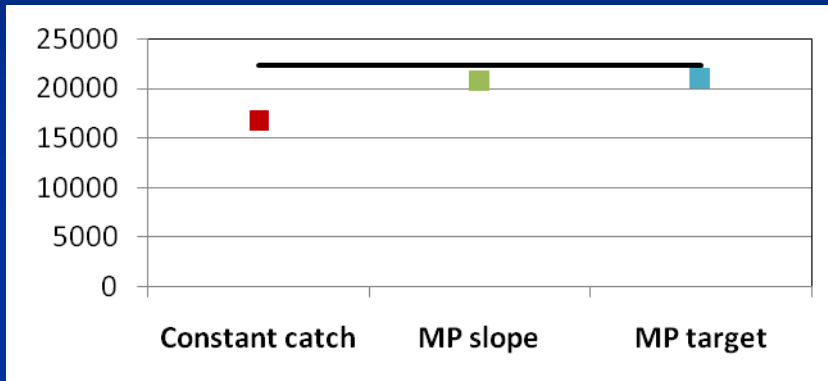

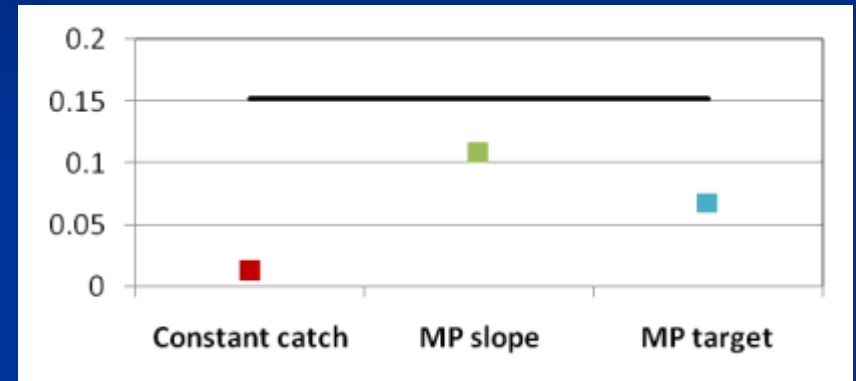**Spawning biomass (tons)**   **Annual catch (tons)**
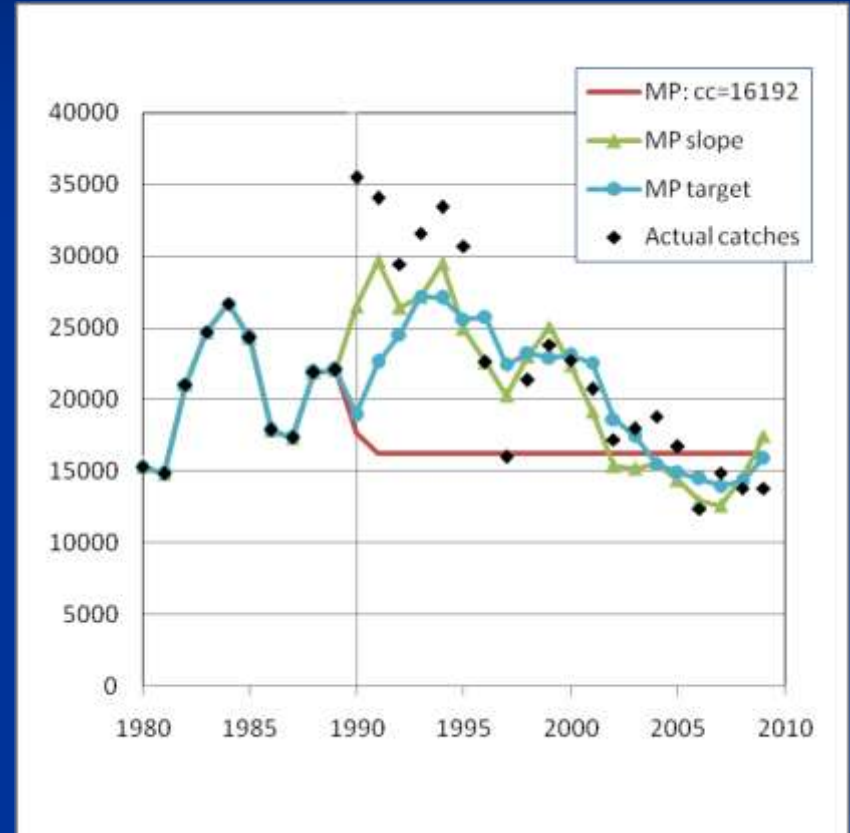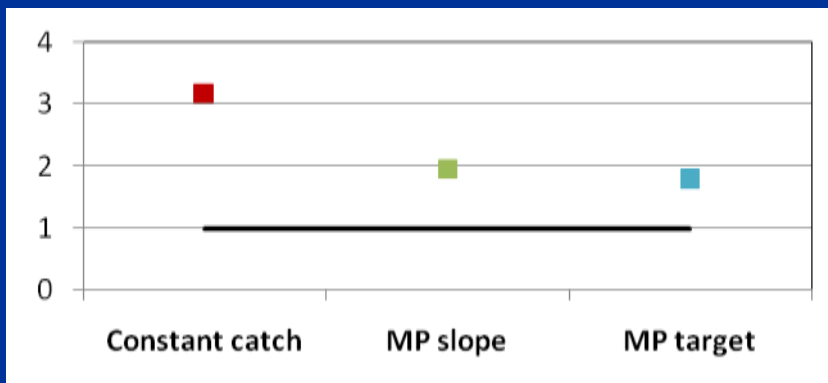
WHAT WOULD HAVE HAPPENED
COMPARISONS TO WHAT OCCURRED
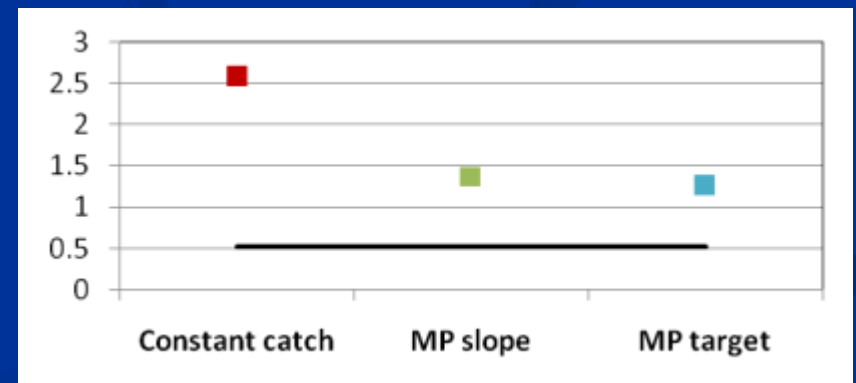## North Sea Sole (Subarea IV)

Annual average catch (tons)
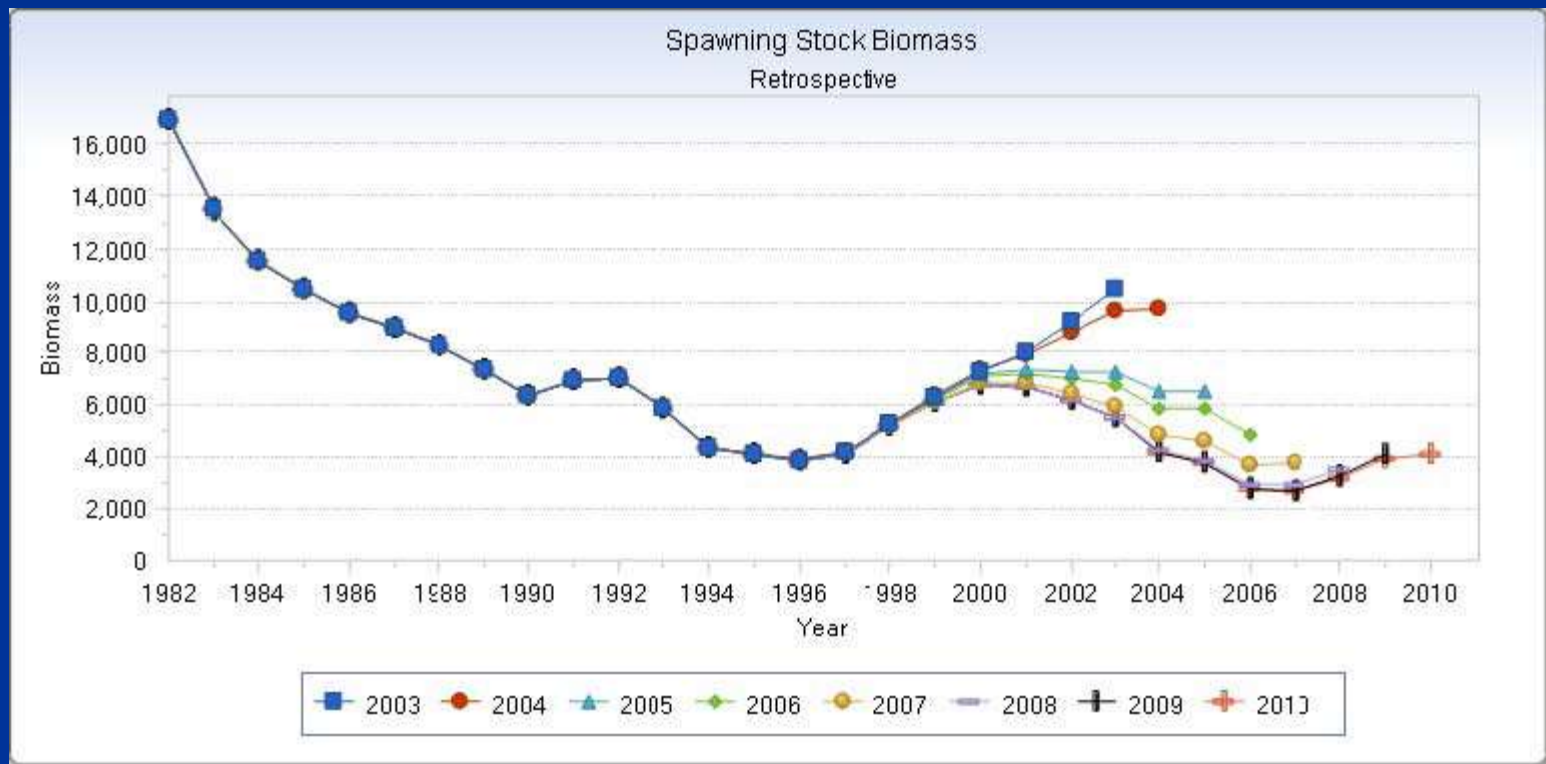

Average change in catch

2010 SSB/SSBtarget

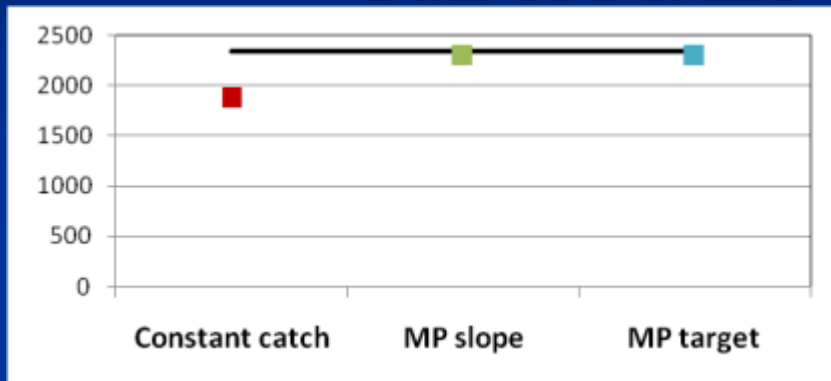

min SSB/SSB target

ASSESSMENTS: RETROSPECTIVE PATTERNS
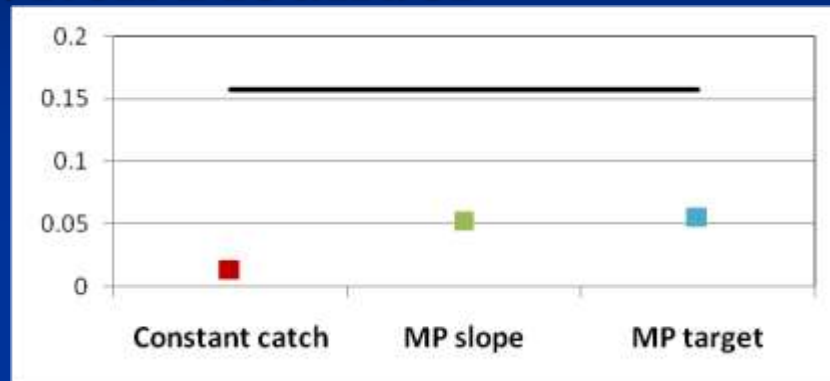## Gulf of Maine Witch Flounder

Plot copied from F. Witch Flounder by S.E. Wigley and S. Emery. NEFSC, February 2012

WHAT WOULD HAVE HAPPENED
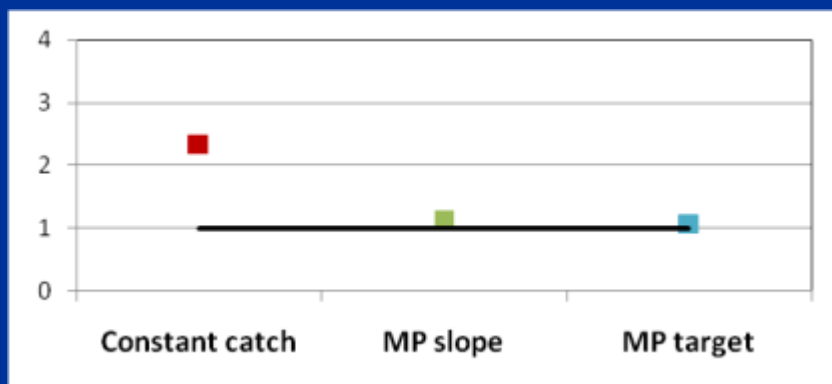## COMPARISONS TO WHAT OCCURRED

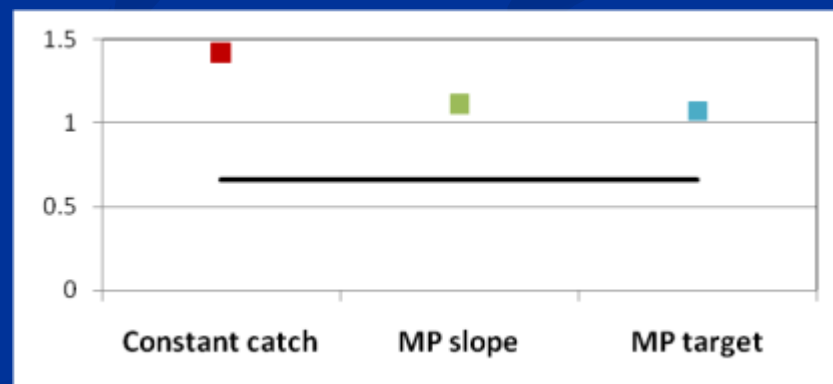## Gulf of Maine Witch Flounder

Annual average catch (tons)

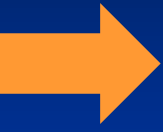Average change in catch

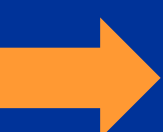2010 SSB/SSBtarget

min SSB/SSB target

INITIAL CONCLUSIONS

MPs perform as well or better than what occurred (based on annual complex assessments)

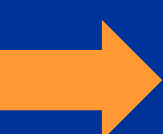Annual assessment based management adds unnecessary variation to management measures without reducing resource risk

Changed role for complex assessments: provide operating models at multi-year intervals for simulation testing of these simpler MPs

Saving on resources otherwise needed for monitoring (e.g. ageing of catch need not be annual)

MP approach seems to be able to handle cases with relatively strong retrospective patterns

SO: PROBLEM SOLVED

USE MPs AND IT'S ALL EASY

REGRETTABLY   NO !!!

MPs are designed to show robust performance to plausible uncertainties

Even with feedback, it is impossible to be robust to "everything"

How do we limit "plausibility"?

III. HOW PRECAUTIONARY?

WHAT DETERMINES HOW UNLIKELY A SCENARIO HAS TO BE BEFORE IT SHOULD BECOME CONSIDERED "IMPLAUSIBLE"

CONSISTENCY PROBLEMS

There is (implicitly) a wide range of views on this worldwide amongst scientists

EXAMPLE I FROM THE USA

- Two M scenarios and two F_{MSY} proxy scenarios to effect recovery to B_{MSY} in requisite period

- Review Panel could hardly distinguish either

- TAC difference covers x[1, 2.5] range

- Panel chose most conservative option for both

- Multiplied by 75% to allow for other uncertainties

- Net reduction of 83% in TAC (later amended to 77%)

- Industry short-medium term future in CRISIS

BEST-ASSESSMENT TAC ADVICE

CHARACTERISATION OF IMPLICATIONS
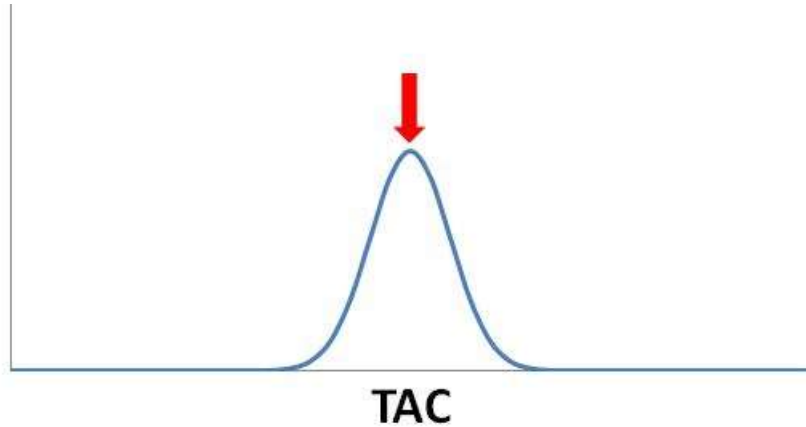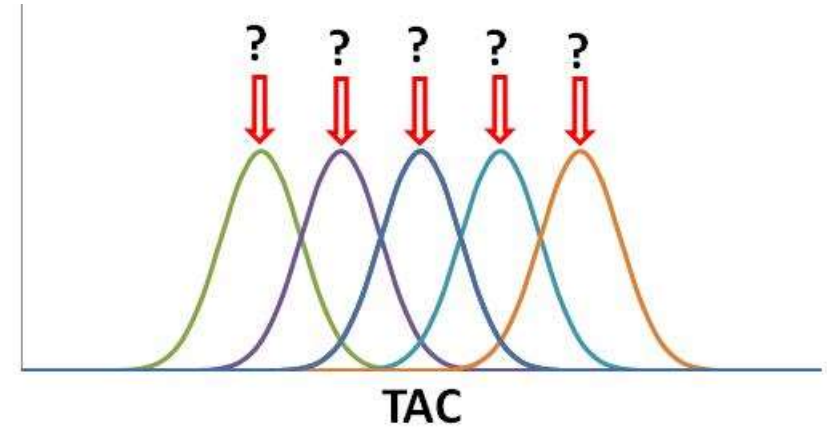
BEST-ASSESSMENT TAC ADVICE
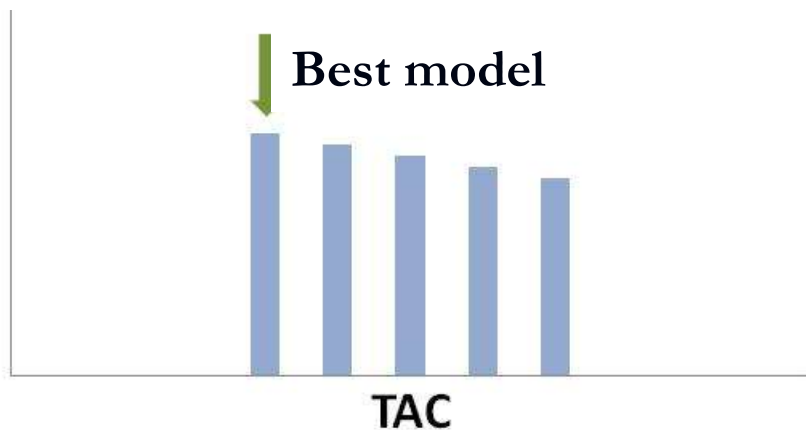
TAC probability distribution
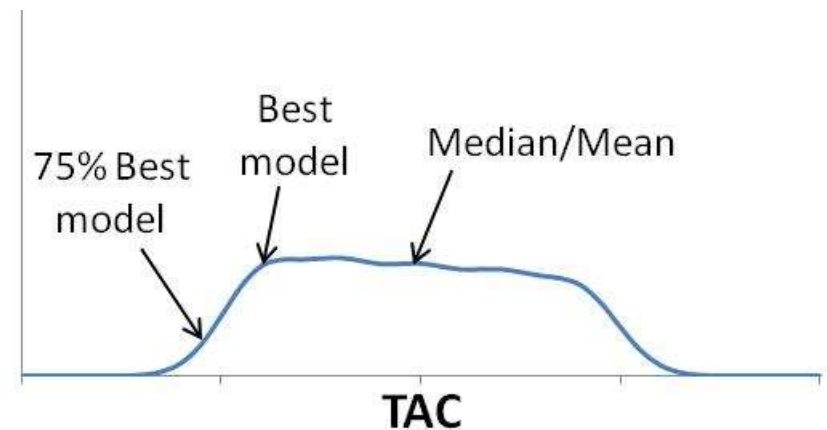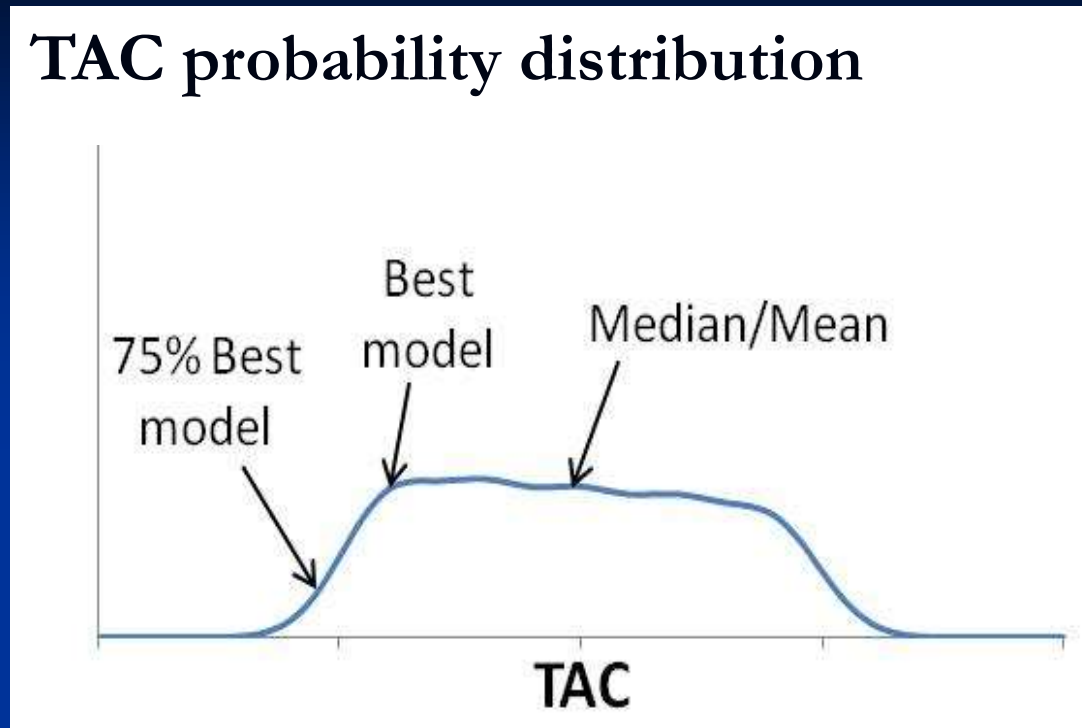
- **What's the appropriate choice?**
- **Over-layering of uncertainty 'adjustments'?**
- **Consistent with the Precautionary Principle?**
  Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing *cost-effective* measures to prevent environmental degradation.

EXAMPLE II FROM SOUTH AFRICA
WEST COAST ROCK LOBSTER

- Resource heavily depleted in the first half of last century

- Estimated to be about 3% of pristine at present
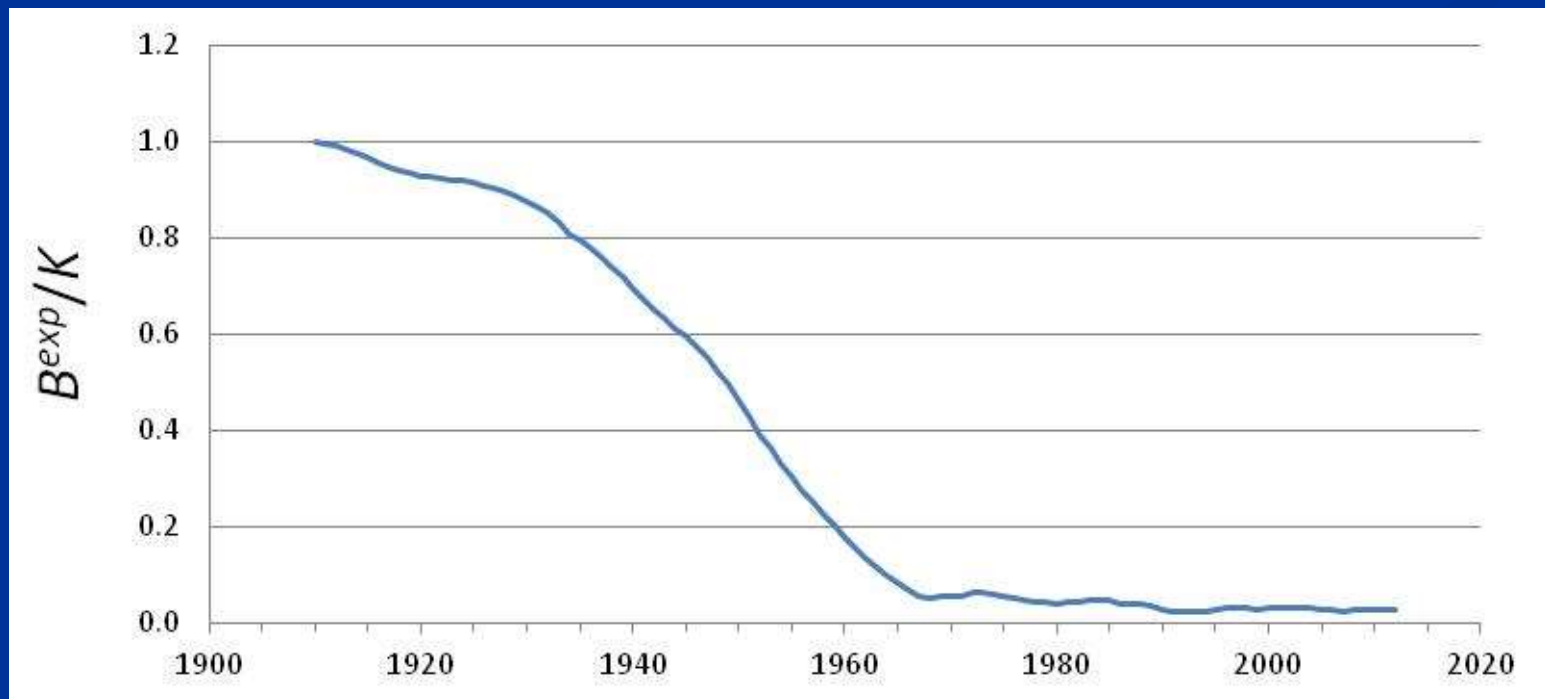
SOUTH AFRICAN ROCK LOBSTER

- Managed under MPs for 15 years

- 2011 MP revision agreed revised recovery target over 35% by 2021 (i.e. 3% to 4%K) - trade off between extent recovery *vs* employment impact

- In 2012 Government overturned MP's 7% TAC reduction arguing "socio-economic" grounds

- First time an MP output overturned this century

- Major protests on front pages of local press from scientists and NGOs

- Green Party institutes court action to close fishery

SA ROCK LOBSTER LITIGATION

- **Scientists support continued harvest under MP**

- **Minister announces commitment to 35% recovery, with MP to be adjusted to effect necessary TAC changes starting one year later**

- **Court rejects application to close fishery**

  "the resource has, in fact, fluctuated between 2% and 4% of pristine since about the 1960's, but notwithstanding this, the resource has continued to be fished sustainably"

  "it would be totally irresponsible of the court to consider … [closing the fishery] … bearing in mind the huge financial implications and social upheaval that would be caused"

THE GREAT NORTH : SOUTH DIVIDE
(or North Atlantic : Rest of the World??)

- **Would "North" scientists (and the MSC?) have considered the MP target chosen and the court judgement defensible (certification consistent)?**

  More commonality on criteria for regime shift confirmation needed

- **Lack of large fish in the catch:**

  1) Overexploitation

  2) Domed selectivity ("hide them")

  3) Increasing M at large ages ("kill them")

"North" scientists are generally very reluctant to accept 2) or 3); "South" scientists accept them regularly if the data are hardly consistent with 1)

Major implications for F_{MSY} proxies based on $F_{spr}\%$

IV. SCIENTISTS – KEY PROBLEMS.

MSY REFERENCE POINT ESTIMATION

In general, do we have the data to estimate MSY reliably?

Are $F_{spr}\%$ proxies defensible – how well do we know M or its age dependence?

How are regime shifts to be confirmed?

V. LOOKING AHEAD.

OBJECTIVES

- **Drop MSY-related targets UNLESS these are reliably estimable directly**

  Set targets in terms of "observables" – past CPUE or survey abundance levels – until reliable MSY estimation becomes possible

  Select recovery rates to targets based on the trade-off between catch/employment reduction *vs* rate of biomass increase

- **Drop *F*-based targets, to be replaced by a focus instead on biomass rate of increase and low levels of inter-annual TAC variability**

LOOKING AHEAD.

ASSESSMENTS

- **Single "best assessments" are not consistent with "best scientific information available" – very seldom can a single model be considered to reflect the range of scenarios compatible with available information**

- **There's a need to move to use of multiple models**

  Not necessarily model averaging

  Primarily "risk analysis" – compare the implications of different management actions across a representative range of models

LOOKING AHEAD.

MANAGEMENT PROCEDURES

- The longer analysis time requirements and lack of expertise will limit large scale introduction

- Nevertheless worth considering applications of very simple MPs further

- Their greatest potential is in management of data-poor stocks for which generic MPs need to be developed urgently

Thank you for your attention

With acknowledgements for discussions and/or assistance with presentation preparation (but WITHOUT implying any co-responsibility for comments made!!):

Helena Geromont

Susan Holloway

Rick Methot

Rebecca Rademeyer