MANAGEMENT PROCEDURES
and
MANAGEMENT STRATEGY EVALUATION (MSE)

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

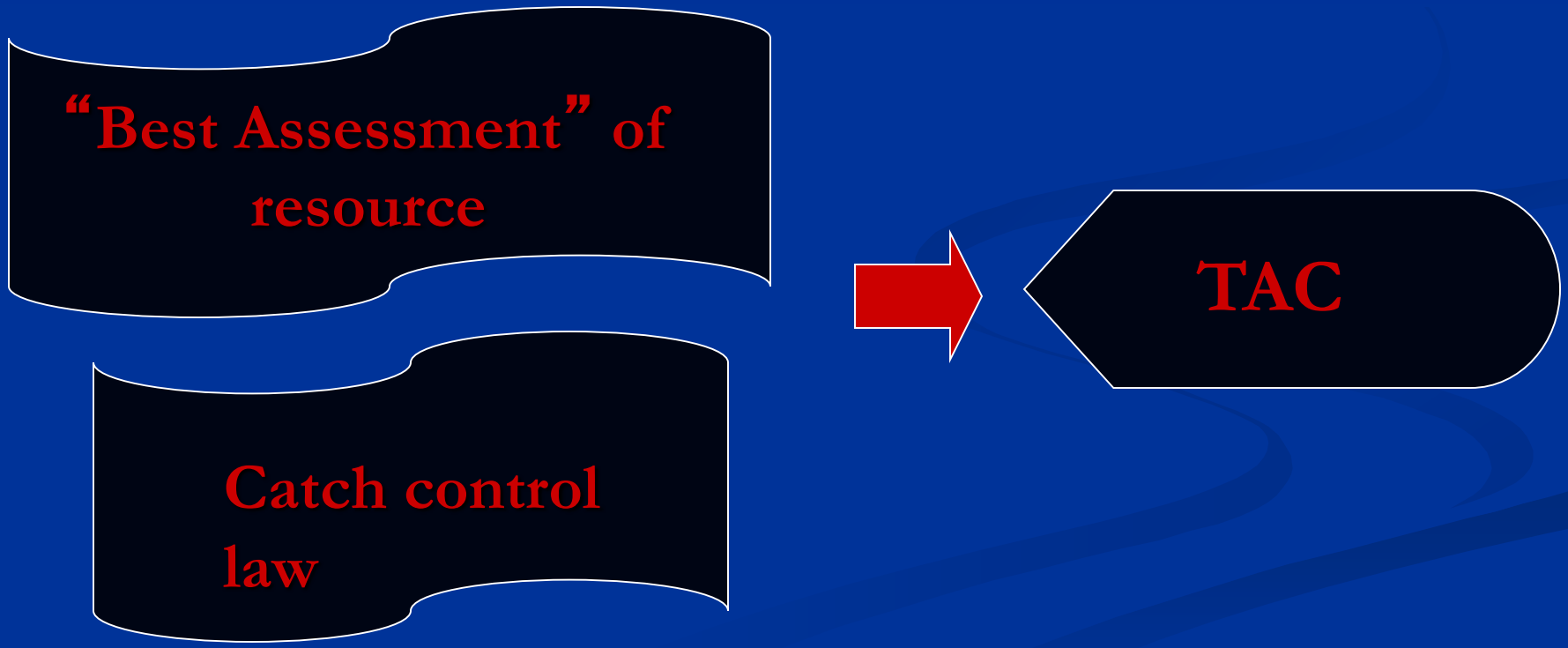
II. Management Procedures (MSE) and feedback

III. Some difficulties

IV. Looking ahead

I. BEST-ASSESSMENT-BASED MANAGEMENT

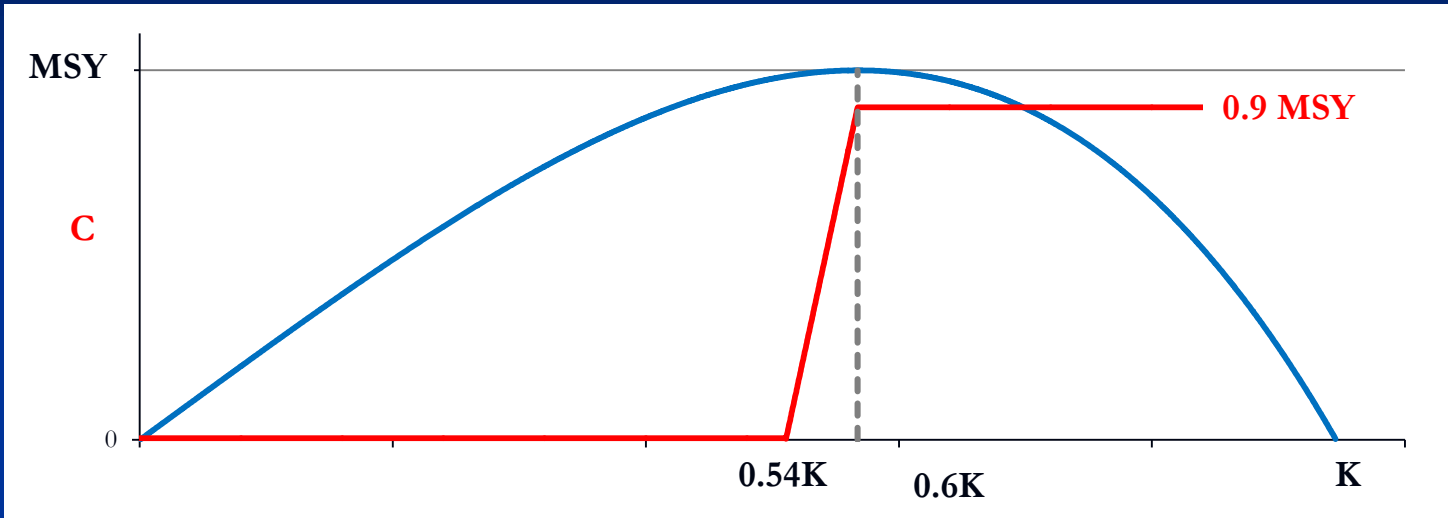
E.g. US Magnuson-Stevens Act with its MSY-related recovery targets



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 objectives and performance measures to quantify the extent to which they are attained (typically relate to catch, catch-variability, and depletion risk but can also include socio-economic considerations)

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: $TAC_{y+1} = TAC^{target}$

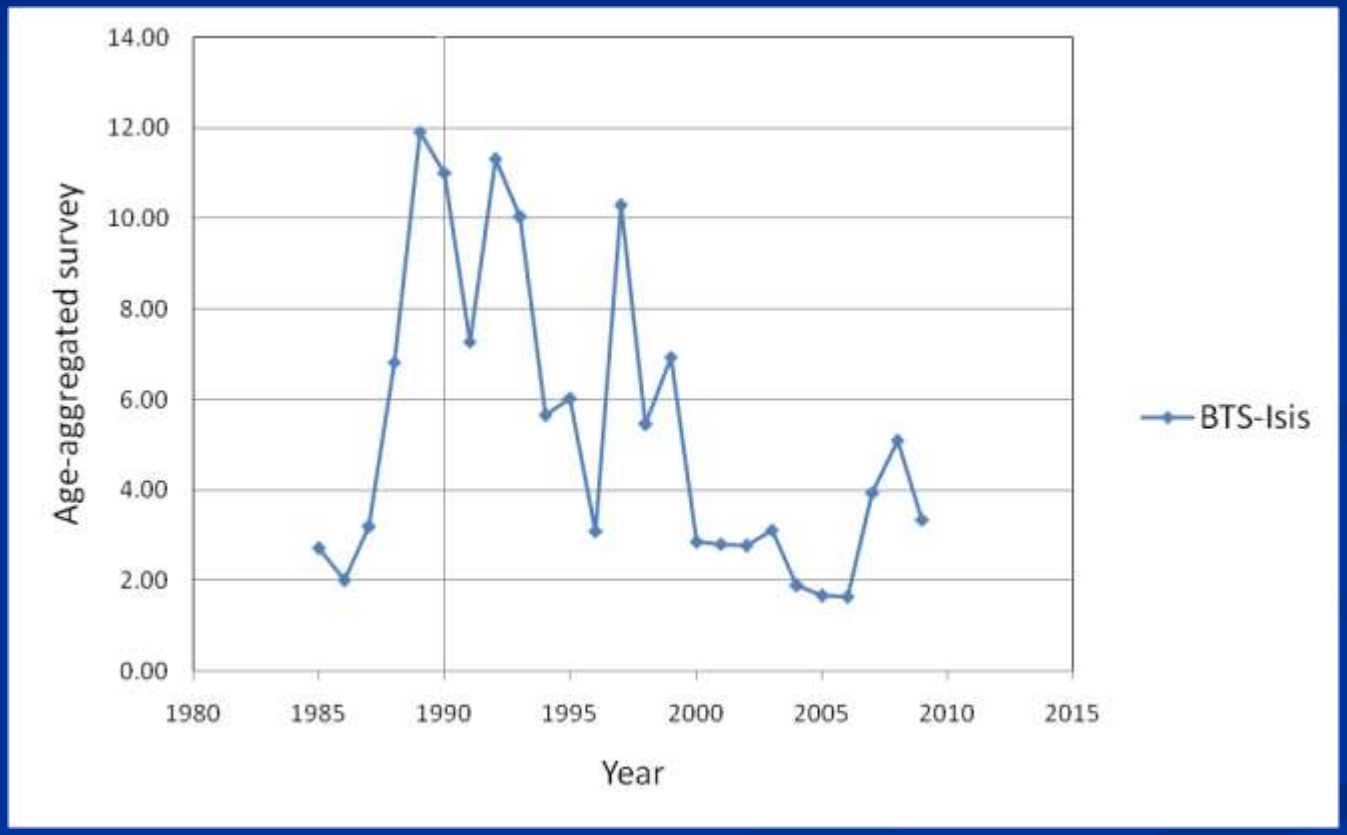
Slope MP: $TAC_{y+1} = TAC_y(1 + \lambda s_y)$

Target MP: $$TAC_{y+1} = TAC^{target}\left[w + (1 - w)\left(\frac{I_y^{recent} - I^0}{I^{target} - I^0}\right)\right]$$

(I = index of abundance available annually)

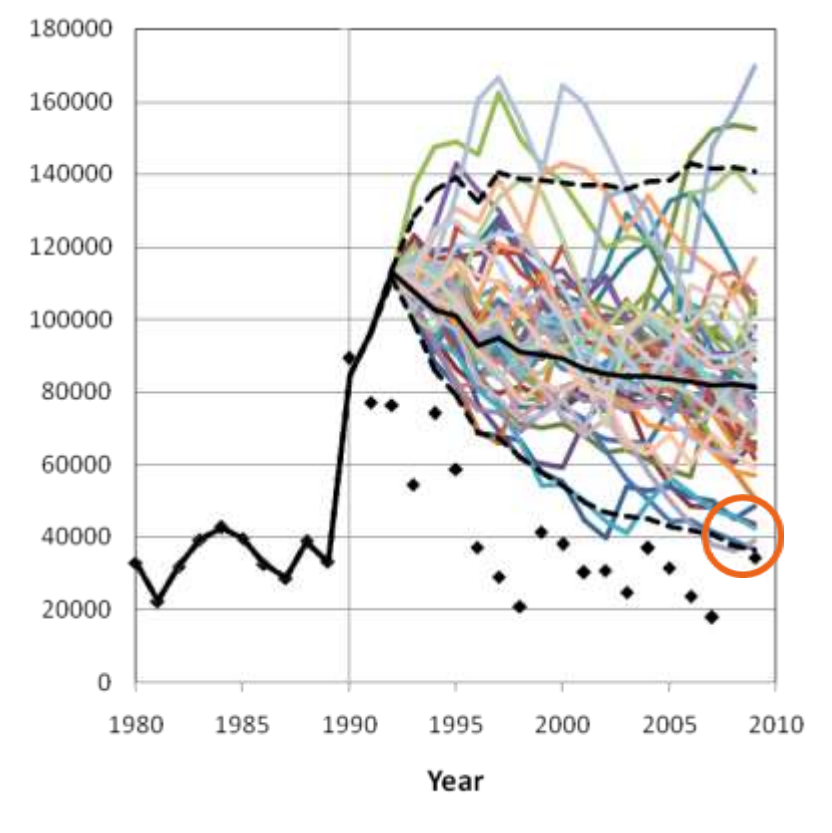
DATA: SURVEY INDEX

North Sea Sole (Subarea IV)

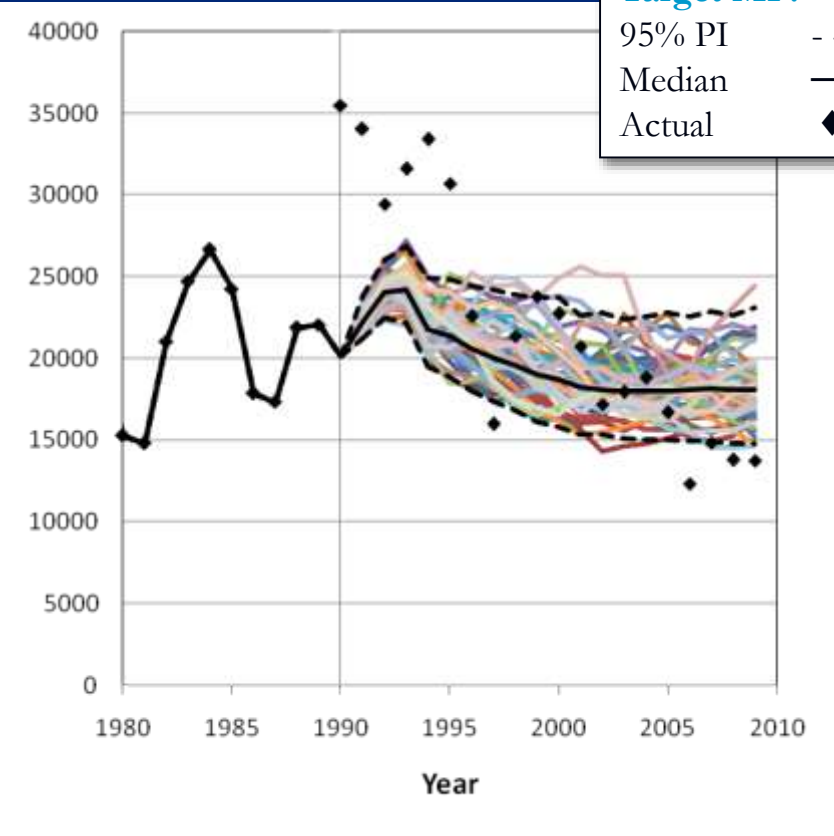


PROJECTIONS UNDER UNCERTAINTY IN 1990

North Sea Sole (Subarea IV)



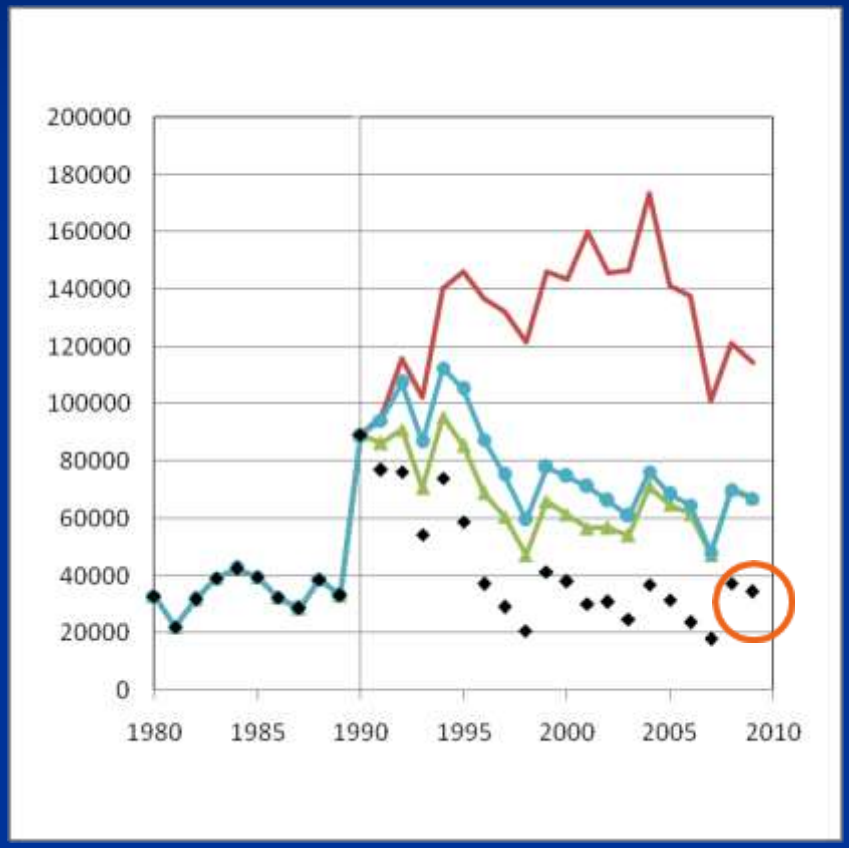
Spawning biomass (tons)



Annual catch (tons)

WHAT WOULD HAVE HAPPENED

North Sea Sole (Subarea IV)



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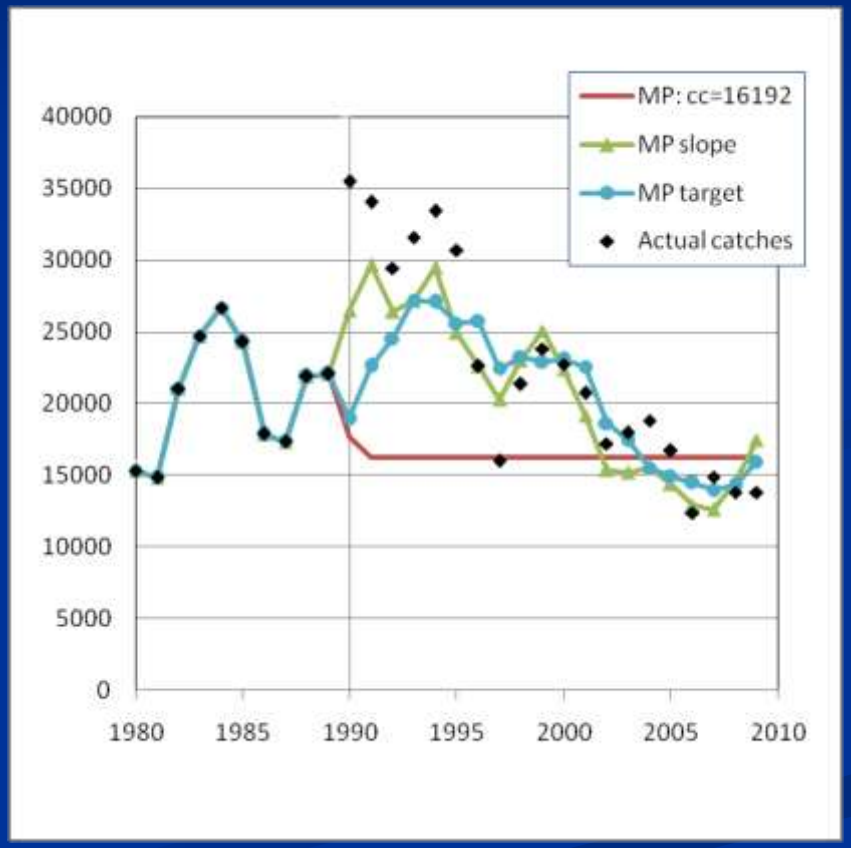

Annual catch (tons)

WHAT WOULD HAVE HAPPENED

COMPARISONS TO WHAT OCCURRED

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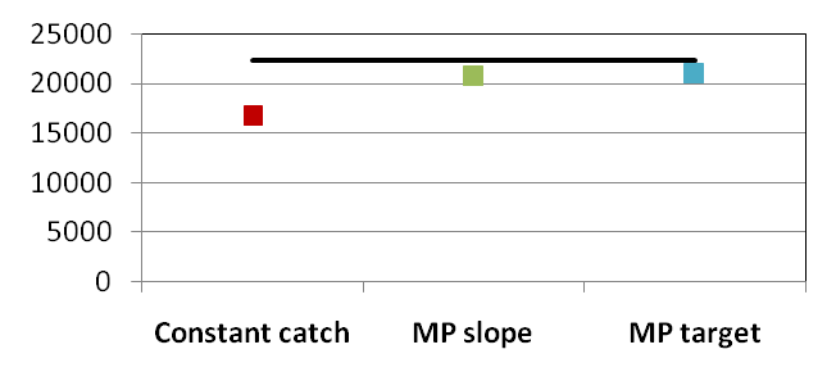
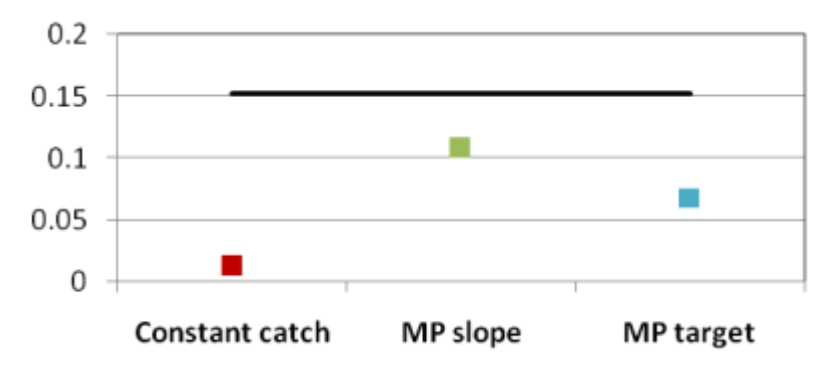
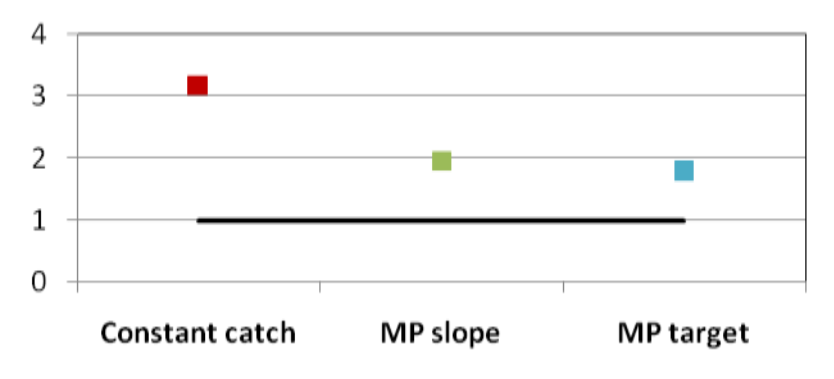


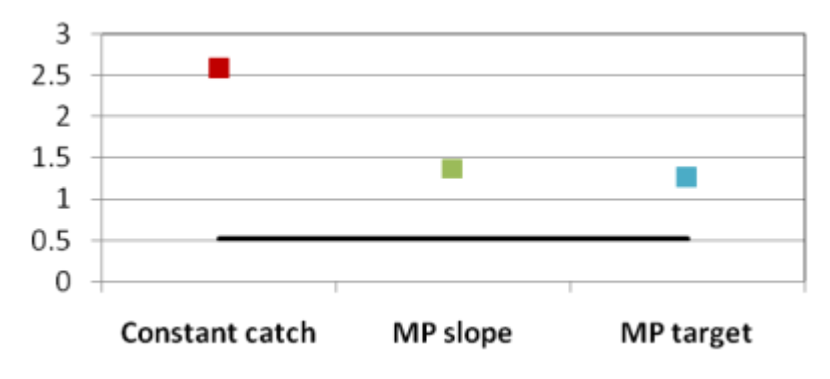
Annual average catch (tons)



Average change in catch



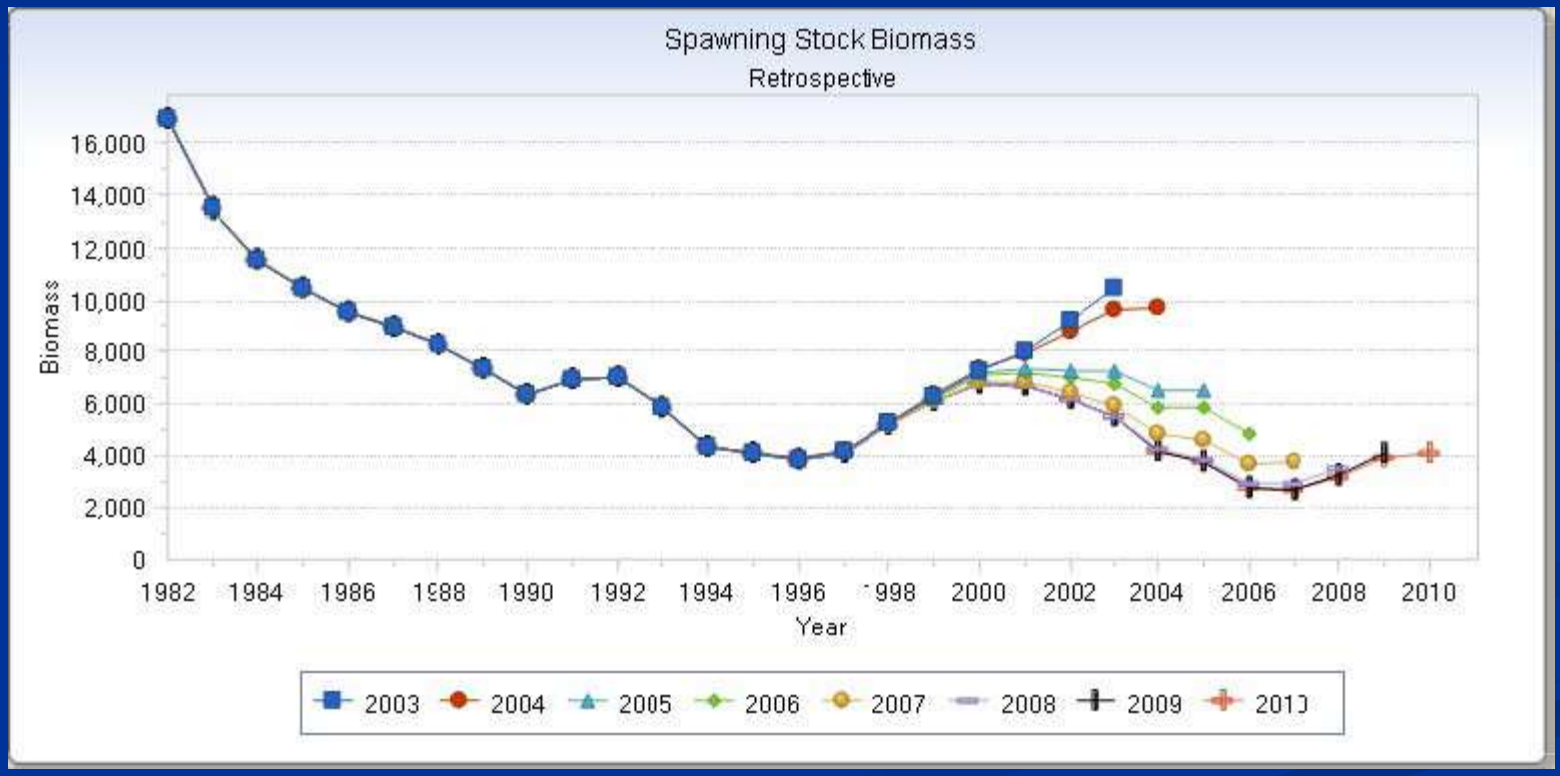
2010 SSB/SSBtarget



min SSB/SSB target

ASSESSMENTS: RETROSPECTIVE PATTERNS

Gulf of Maine Witch Flounder

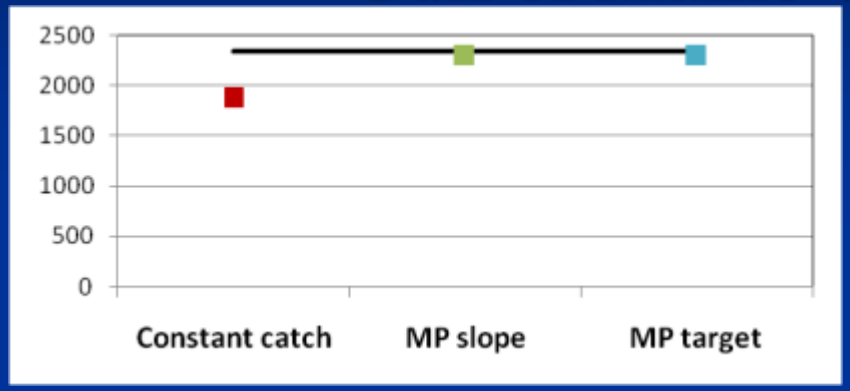


Plot copied from F. Witch Flounder by S.E. Wigley and S. Emery. NEFSC, February 2012

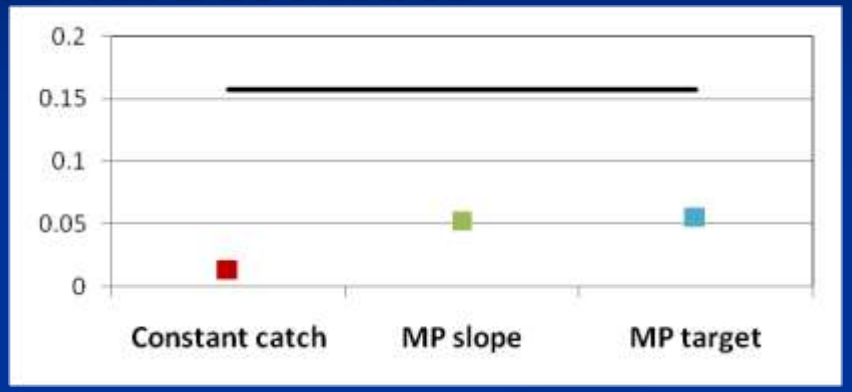
WHAT WOULD HAVE HAPPENED

COMPARISONS TO WHAT OCCURRED

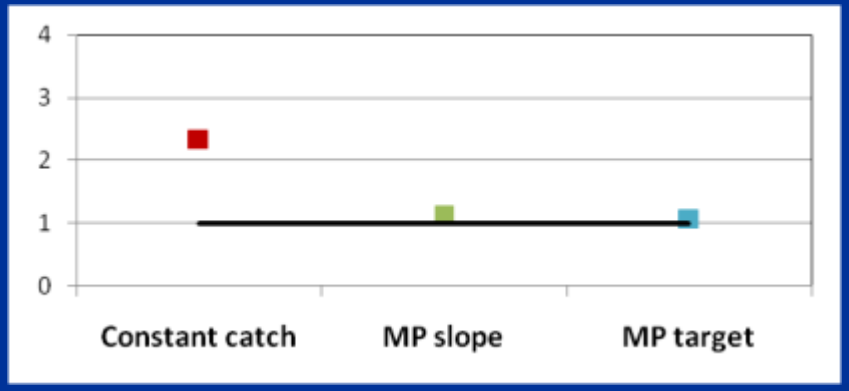
Gulf of Maine Witch Flounder



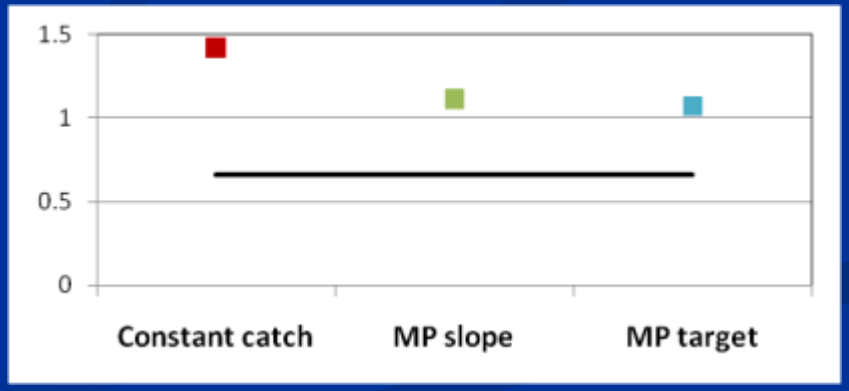
Annual average catch (tons)



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. SOME DIFFICULTIES

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

FURTHER DIFFICULTIES

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?

IV. 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 and limits, 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

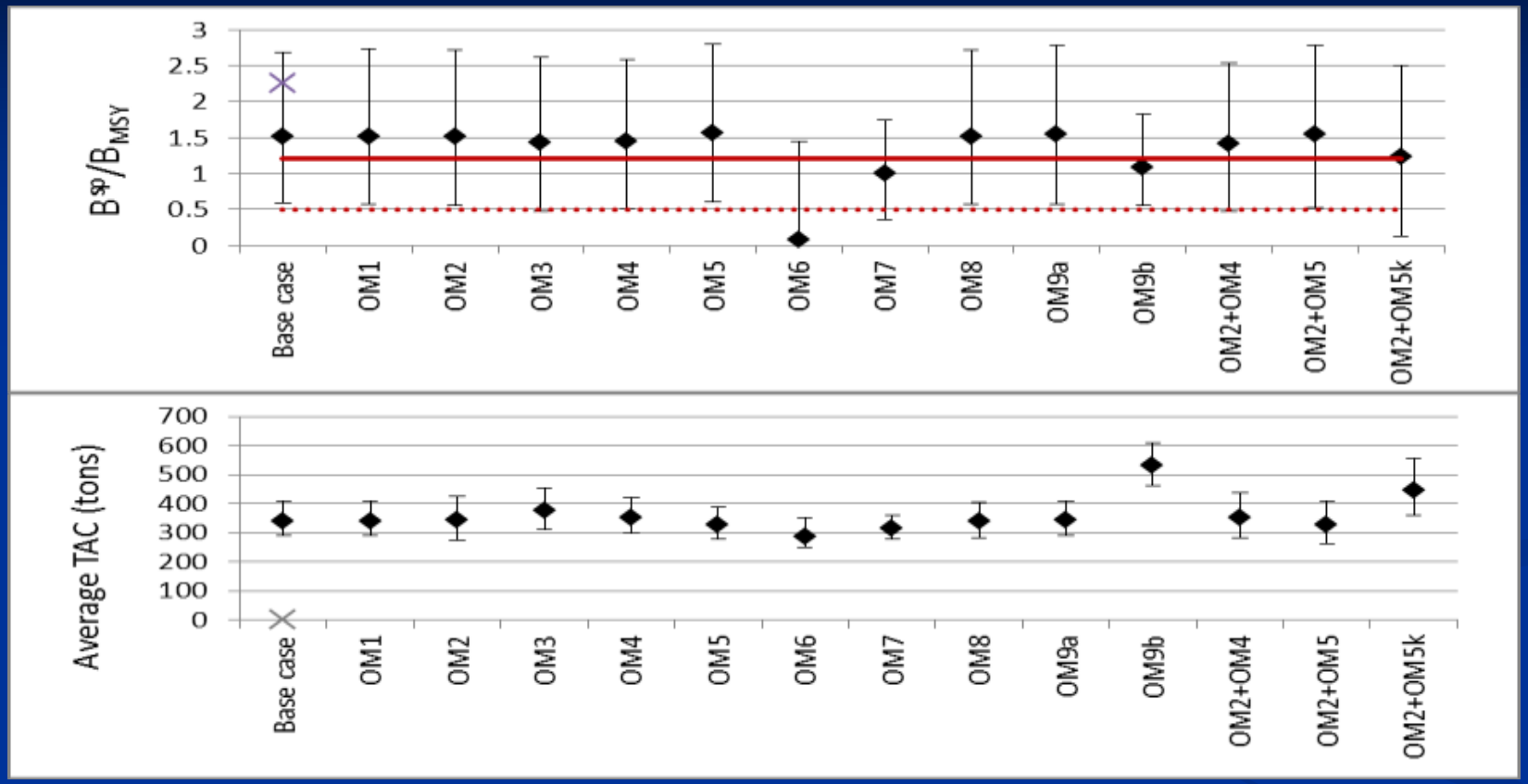
- The longer analysis time requirements and lack of expertise will limit large scale introduction
- Nevertheless worth considering applications of very simple MPs further
- Does current US law raise any complications?
- $F < F_{msy}$ requirement
- MP philosophy – evaluate in terms of performance measures; there need be no design criteria
- If biomass targets are met, depletion risks controlled and catch variability constrained, what need for constraining *F*? (Unless *CPUE* proportional to *F* and effort control required)

LOOKING AHEAD

MANAGEMENT PROCEDURES

- Their greatest potential is in management of data-poor stocks for which generic MPs need to be developed urgently
- Consider a severely depleted (*B/K* in 10-30% range) of medium productivity (*M* in range 0.2 to 0.4) with the only data available catch and its mean length
- Apply a simple target-type MP based on mean length to achieve recovery to (beyond) B_{msy} (work by Helena Geromont)

ROBUSTNESS TO UNCERTAINTIES



- Tests relate primarily to errors in catch and systematic changes in selectivity
- Surprisingly robustness performance in achieving recovery
- Exceptions for B/K = 5% and M=0.1 (i.e. outside range for which MP designed)

Thank you for your attention

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

Helena Geromont
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