

# MANAGEMENT PROCEDURES AND MSE: ORIGINS AND PROSPECTS

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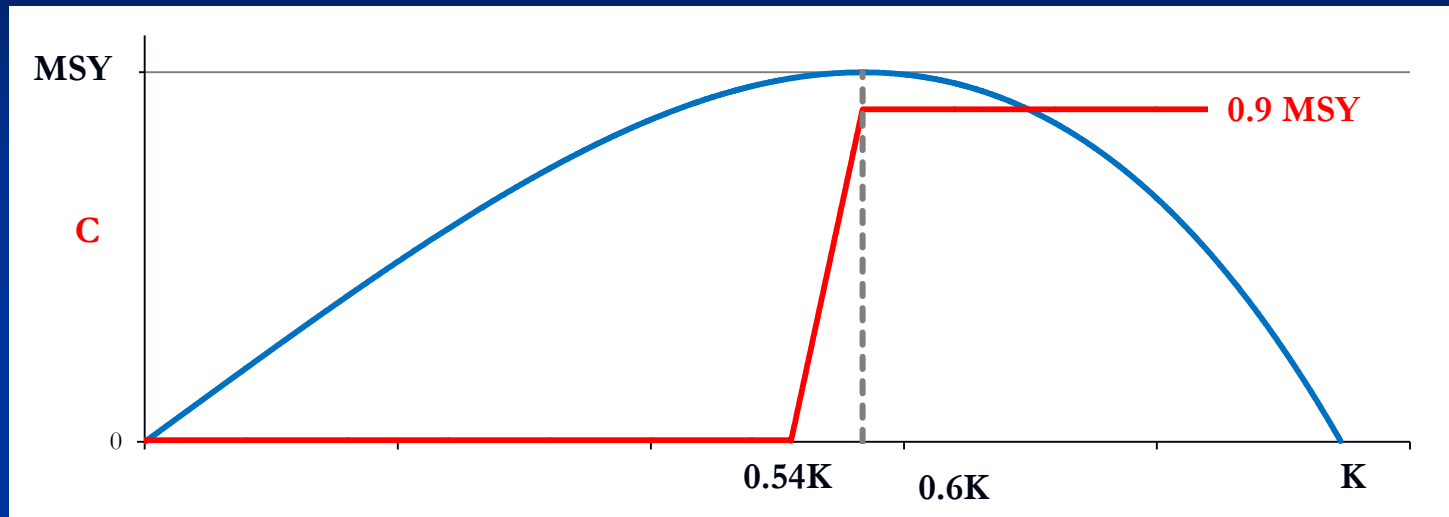
# OUTLINE

- I. The History of MPs in the IWC Scientific Committee
- II. IWC: Lessons learnt
- III. Criticism of MSE
- IV. Model-based *vs* Empirical MPs
- V. Problem Areas
- VI. Summary
- VII. The Future

# I) THE HISTORY OF MPs IN IWC SCIENTIFIC COMMITTEE

- Mid-1960s : First quantitative assessments of over-exploitation
- 1972 : First Conference on the Environment, Stockholm: Strong criticism of IWC
- 1976 : Development in IWC Scientific Committee of the New Management Procedure (NMP)

# IWC NEW MANAGEMENT PROCEDURE (NMP) 1976



## Harvest Control Rule:

$$C = 0 \quad \text{for } P < 0.54 K$$

$$C = 0.9 \text{ MSY} \quad \text{for } P > 0.60 K$$

## 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

Lesson still not learnt three decades later?

e.g. US M-S Act (e.g. MSY proxies)

# IWC REVISED MANAGEMENT PROCEDURE (RMP) (1987-1992)

## BASIC APPROACH

- 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

# KEY ASPECTS

What really matters is **NOT** design features of MPs and their HCRs, but resultant **PERFORMANCE STATISTICS** and their robustness for different **OMs**

**Objectives:** Pre-specified

**MP features:** No restrictions

**Selection:** Based entirely on performance statistics

# II) IWC: LESSONS LEARNT

## ORGANISATION

### IDEALLY

- Operating Models/Testing software programmed independently of MP developers
- Alternative MPs developed and tested using such software by “constructively competing” groups

### BUT

Difficult to achieve other than in RFMO  
setting



# IWC: LESSONS LEARNT

## SIMPLICITY

- The information content of fisheries data is usually low
- **SIMPLE** MPs **ARE** able to use much/most of that information
- More complex approaches may be following **NOISE** rather than **SIGNAL**  
(e.g. use of age information?)

**NB:** These comments apply to the MP, and **NOT** to the OMs

# IWC: LESSONS LEARNT

## GENERIC OR CASE SPECIFIC

- The RMP (at least its Catch Limit Algorithm component) is **generic** though its estimator and data inputs are (pre-)specified
- In practice additional simulation tests of each implementation for a particular species-region has proved necessary (**stock structure uncertainty**)
- ? Go **case specific** from the start?
- ? Is the practical role for “**generic**” MSE limited?  
e.g. an HCR will not necessarily behave the same way under a different estimator

# III) CRITICISM OF MSE

## TWO RECENT PAPERS:

- Rochet and Rice: “ignorance disguised as mathematics” (ICES JMS 2009)
- Kraak *et al.*: “discomfort in fisheries advisory science” (Fish and Fisheries 2010)

MOST COMMENTS DO NOT APPLY TO MPA (*sensu* IWC) OR TO MSE (*sensu* Australia)

(?) EXCEPT (?)

The role for use of “INTELLIGENCE”

# ”INTELLIGENCE” VS TINKERING

## ■ **Rochet and Rice:**

“this is the wrong time to remove intelligence from the process ... simulation-based MSEs can only evaluate impoverished procedures, those without the need for human intervention. This is not the type of management procedure we want.”

**ADAPT excluded as an MP because it requires** “educated choices that cannot be simulated in an operating model”

## ■ **Kraak *et al.*:**

Iterative deliberations where model output is modified by inputs from oceanographers, biologists and fishermen.

**They (?? seem to ??) propose that annual MP output be routinely modified using other information, as can occur in the standard stock assessment process**

# ”INTELLIGENCE”

## VS TINKERING

THIS IS IN COMPLETE CONTRADICTION TO  
THE BASIC MP APPROACH PHILOSOPHY

!!! NO TINKERING !!!

- The MP approach was set up precisely to avoid such annual debates and *ad hoc* TAC adjustments (“tinkering”)
- MP output should be implemented AS IS (“autopilot mode”) except in infrequent cases where there is **compelling** contrary evidence (“Exceptional Circumstances” provisions)
- If a procedure has not/cannot be simulation tested, how can one be confident that it will behave better than one which has?
- How reliably determined are the implicit hypotheses underlying the rationales offered for the tinkering? Are the associated data signal or noise?

# THE PROPER PLACE FOR INTELLIGENCE

- Regular reviews of MPs and the OMs used to test them
  - About 5-yearly
- “Exceptional circumstances” provisions
  - When MP output may be overridden and/or review advanced
  - Criteria – essentially: **situation outside range tested**
- Relationships used in MP rules must be data-based/confirmed
- MP specifications must be accompanied by agreed written **PROTOCOL** spelling out such provisions

# IV) 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

# V) 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

# SCHEDULING

## MP DEVELOPMENT

- 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
- Plan for slippage on deadlines
  - TACs in the short term can be very dependent on operating model selection and weighting



PRESSURE FROM INTEREST GROUPS

# VI) SUMMARY

## ■ STAKEHOLDER INTERACTION FRAMEWORK

- Interactions with managers, industry etc. from day **ONE**
- Being part of process ⇒ More likely to accept outputs

## ■ MP FEATURES

- Based on operational/estimable constructs and relationships
- Keep it simple
- Empirical rather than model-based (readier understanding)
- Selection on performance, not design features

## ■ IMPLEMENTATION ASPECTS

- **No tinkering** (compelling evidence for output modification – “Exceptional Circumstances”)
- Review about every 5 years
- Scheduling deadlines for data and OM finalisation

## ■ PRIORITIES FOR FURTHER WORK

- Intelligible measures or risk
- Formal means to “weight” robustness tests in MP selection

# VII) THE FUTURE

## ■ UTILISATION INCREASE

- “Traditional”: IWC, South Africa, Australia, New Zealand
- Recent: NAFO, CCSBT, Canada
- Prospects: Other Tuna RFMOs, USA(?), EU (?)  
Pressure from MSC

## ■ TO OVERCOME

It's better than the best assessment approach, BUT

- Understanding (scientists, managers, stakeholders)
- Time required
- Expertise requirements

**Thank you for your attention**

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