

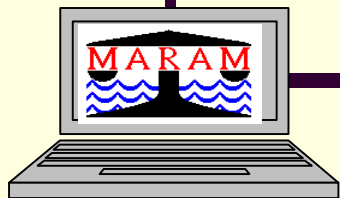
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# **Making Management Procedures Operational**

**– innovations implemented in South Africa**

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# “OPERATIONAL” Management Procedures

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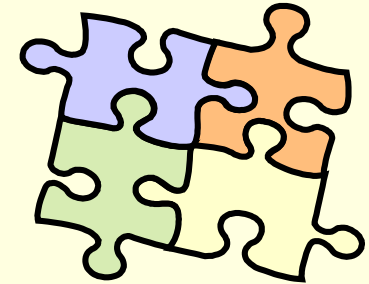
- Applied in South Africa since the early 1990’s
- “Operational” implies of a form ready for immediate implementation to provide quantitative advice, in contrast to a broad concept only

**A key aspect of the MP approach is that the analysis procedure has been tested across a wide range of scenarios for the underlying dynamics of the resource using computer simulation.**

**This is to ensure that the likely performance of the MP in terms of attributes such as (high) expected catch and (low) risk of unintended depletion is reasonably robust to the primary uncertainties about such dynamics.**



# What's an OMP?

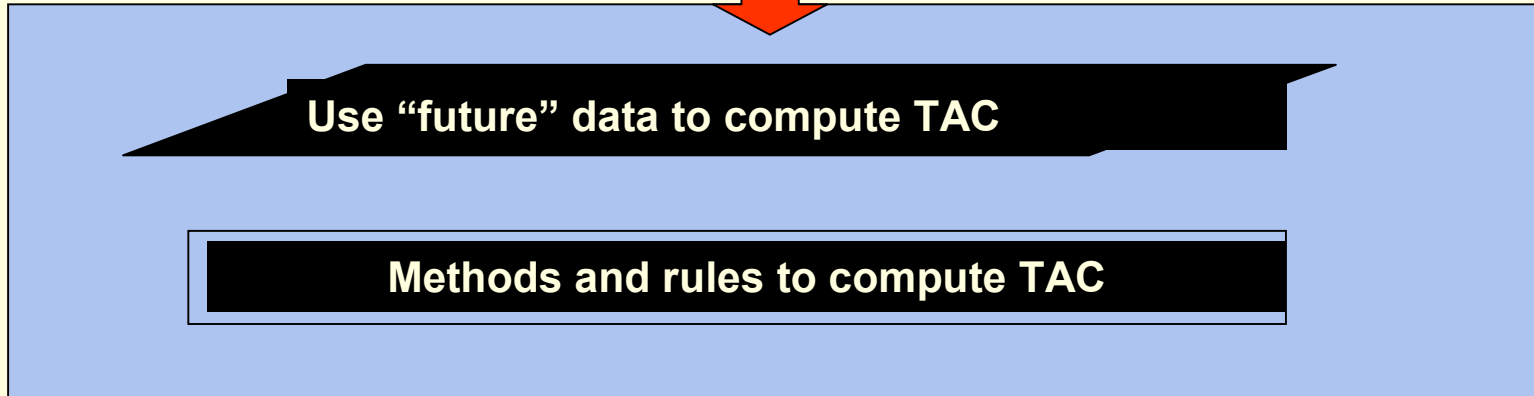


- Simulation-testing framework: operating model to simulate the “true” dynamics of the resource.
- Different MPs simulation tested : performance compared on the basis of an agreed set of performance statistics
- “Future data” (e.g. CPUE indices of abundance) generated from operating model - same error structure as in the past
- Data passed to the MP and back to the operating model
- Performance compared re risks of reducing abundance to low levels, as well as variability in future TACs and average catches
- Final choice: reasonably robust performance re expected catches and risk to the resource, given prevailing uncertainties about resource status and dynamics

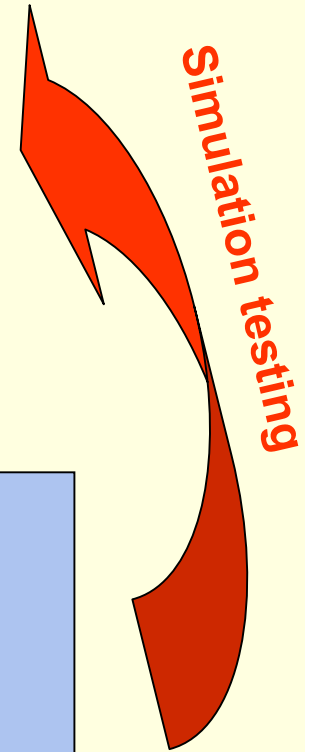
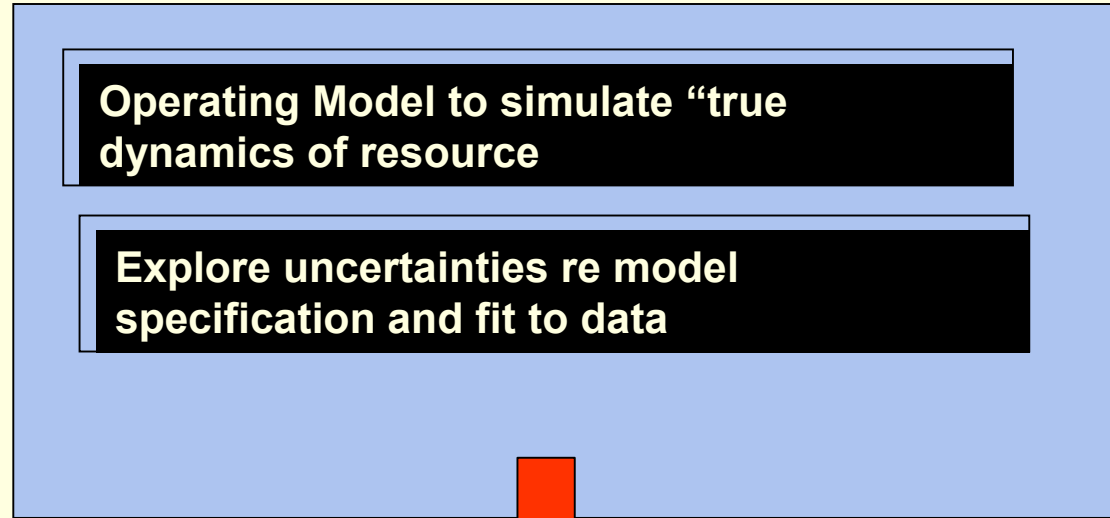
# What's an OMP?

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**MANAGEMENT  
PROCEDURE**



**OPERATING  
MODEL**



# South African *Operational* MPs

- Demersal hake fishery: deep-water *Merluccius paradoxus* and shallow-water *M. capensis* hake species
- Pelagic fishery: sardine (*Sardinops sagax*) and anchovy (*Engraulis encrasicolus*)
- West Coast rock lobster resource (*Jasus lalandii*)
- In prep: Patagonian toothfish (*Dissostichus eleginoides*) (Prince Edward Island EEZ), SA squid (*Loligo vulgaris*) and South Coast rock lobster (*Palinurus gilchristi*)





# Recent innovations and adaptations

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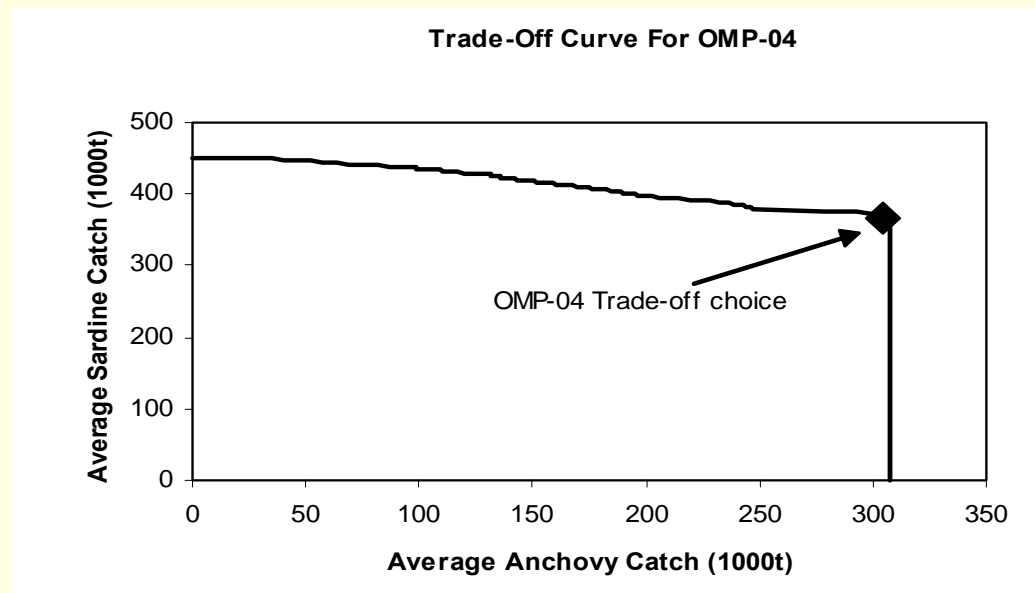
- a) Joint two-species MPs
- b) A Reference Set of weighted operating models for primary testing and tuning in preference to a single model
- c) Applying a Donovan-Hammond approach to allow greater catches in the short term conditional on research being implemented to resolve a key uncertainty
- d) Incorporating ecosystem considerations by developing appropriate robustness tests (which links with moves towards an Ecosystem Approach to Fisheries - EAF)
- e) Protocols for deviating from a MP



# Joint two-species MPs

- Juvenile anchovy catch + bycatch of juvenile sardine
- Need trade-off between directed anchovy and sardine catch
- Hence fisheries managed jointly, using a MP chosen to explicitly account for this trade-off
- MP chosen from a “trade-off curve” depicting the average predicted directed sardine catch against the average predicted anchovy catch under the proposed MP

■ “Trade-off curve” constructed to explicitly meet chosen risk criteria to ensure that neither of the resources would be severely depleted



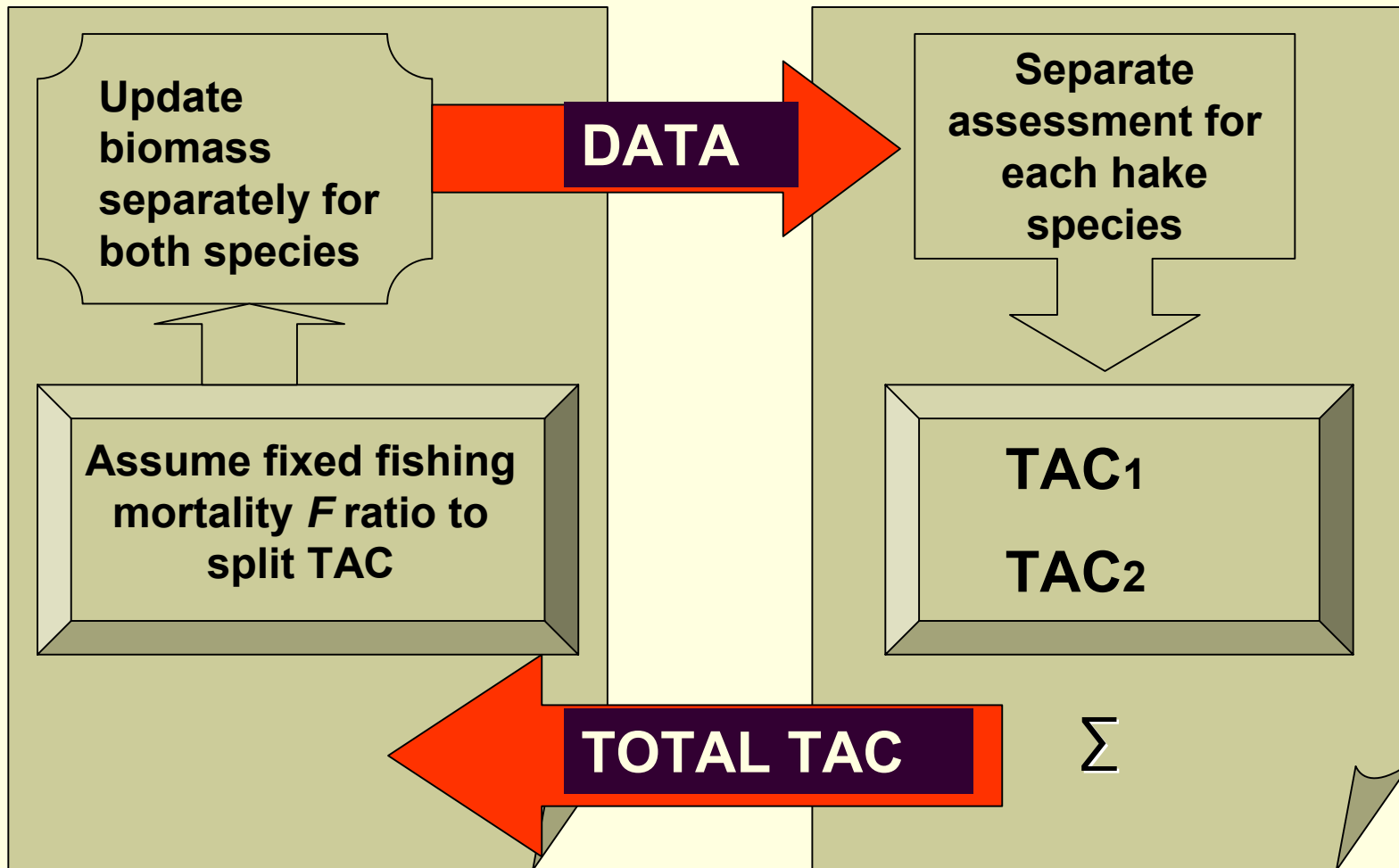
# Joint two-species MPs: SA Hake

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- South African hake resource comprises two species *but* commercial catch records do not distinguish between them
- Practical difficulties (possibly insurmountable) of setting separate TACs for each species and then monitoring compliance - split catch by species on landing? No
- Example provided re including up to date information in a MP, but taking account of limitations arising from the practicality of certain management options

## OPERATING MODEL

## MANAGEMENT PROCEDURE



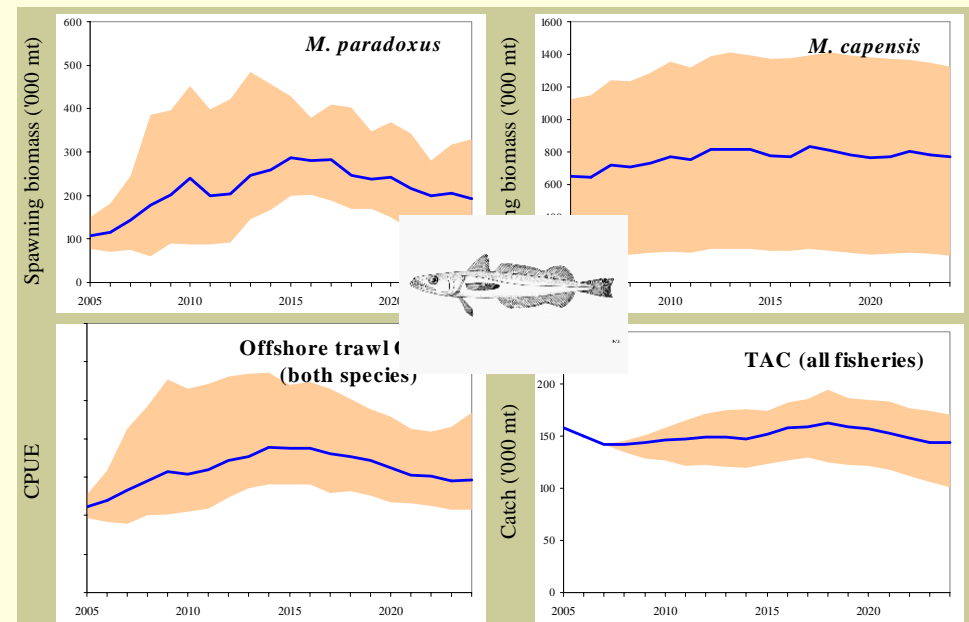
# Reference Set of Operating Models

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- Replicate projections arising from a so-called Reference Case operating model frequently used for the primary testing of a candidate MP, and for tuning its control parameters to achieve the trade-off choice between conflicting objectives that is sought by managers
- Performance also considered across a large number of robustness tests, each representing alternative plausible “states of nature” that are compatible with the available data

# Reference Set of Operating Models

- Difficulty in agreeing a single operating model re current “best assessment” of the resource, select the major (typically 3-5) sources of uncertainty, consider 2-3 alternative specifications for each, and treat the resultant combination of operating models as a “Reference Set”, with tuning and perhaps also evaluation of meeting risk-related criteria evaluated across this set



# Donovan-Hammond approach

- Initial trials re revised SA hake MP: key uncertainties associated with separating the commercial offshore trawl catch by species based upon information regarding the species ratio by depth provided by research surveys
- Satisfying risk criteria across a full range of possibilities for bias in such estimates leads to very conservative MP (i.t.o catch)
- Innovative solution = “Donovan-Hammond” approach - adopted by the IWC SC\* (in 2004) to allow "less safe" RMP# variants **provided** that experiments simultaneously scheduled to determine whether or not a "nasty" hypothesis applied in reality.

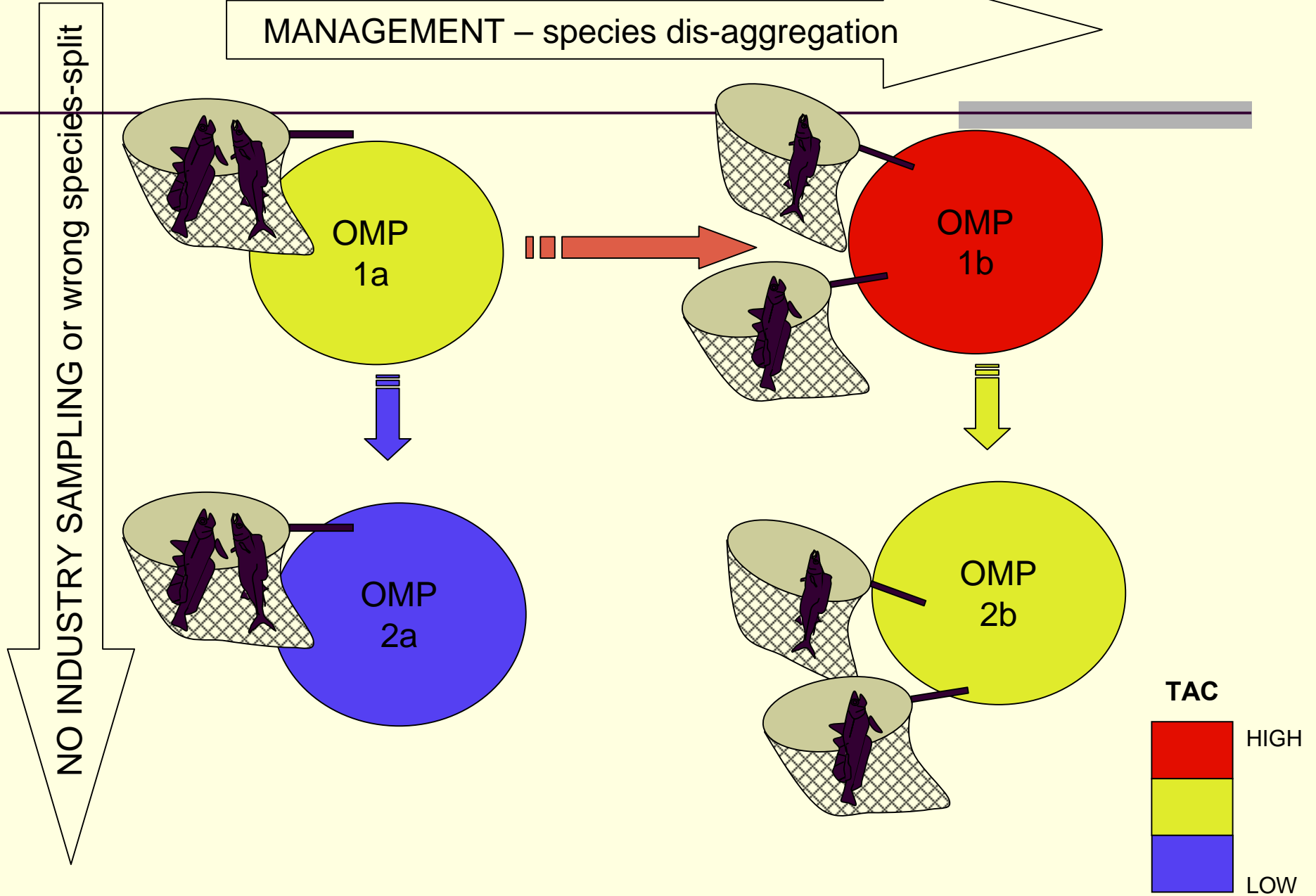
\* [International Whaling Commission Scientific Committee]

# [Revised Management Procedure]



# South African hake

MANAGEMENT – species dis-aggregation



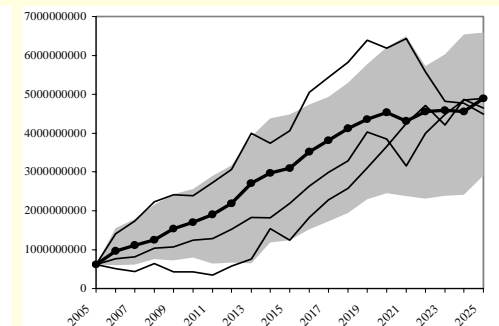
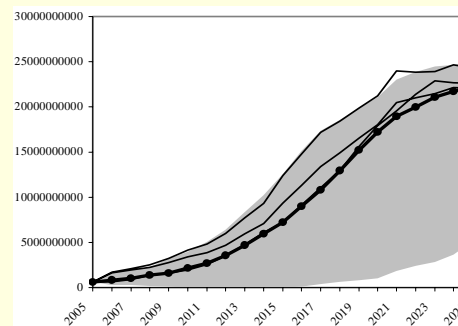
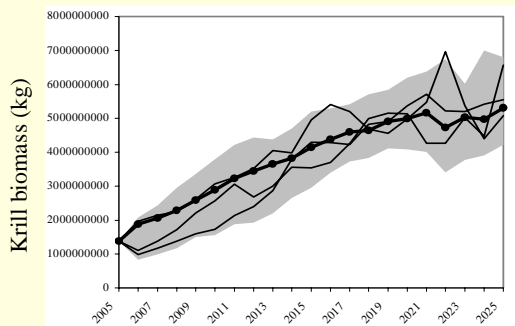
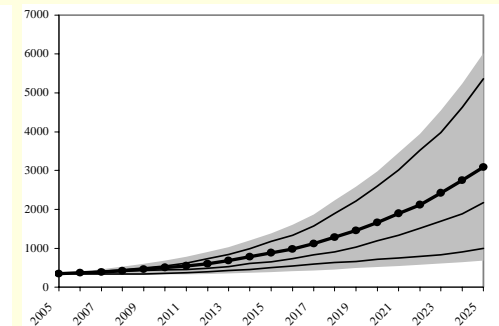
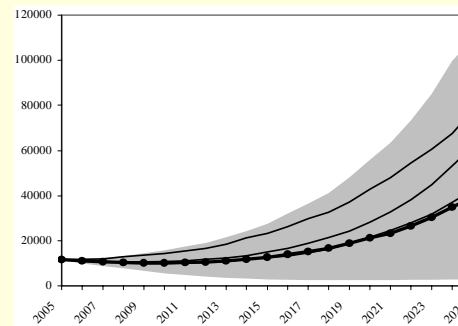
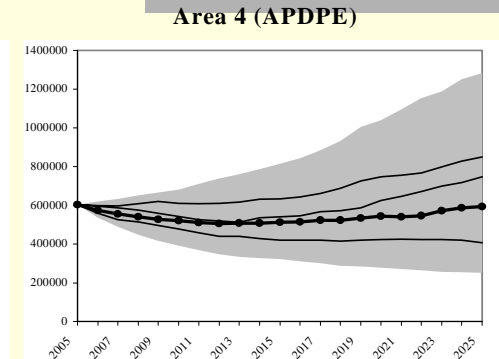
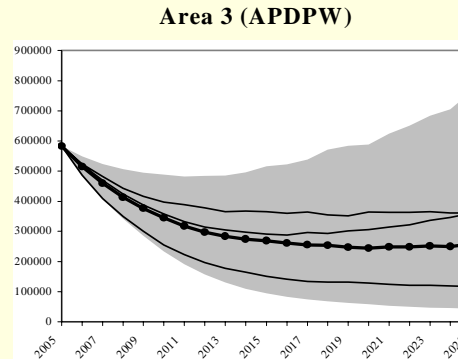
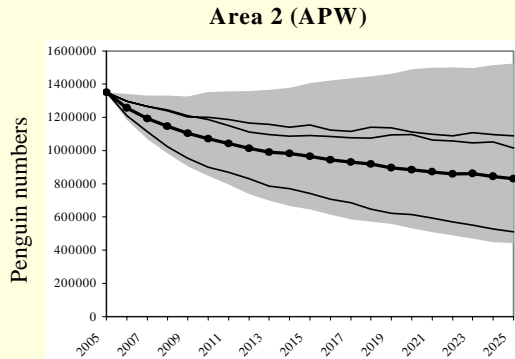
# Incorporating ecosystem considerations

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- MP testing procedures can use changes in single species parameters (such as carrying capacity  $K$ ) as a surrogate for ecological ecosystem effects that are difficult to incorporate explicitly in operating models
- Technical ecosystem effects such as bycatch concerns can also be included as Robustness tests in the MP testing process
- These additions constitute a first step towards incorporating ecosystem aspects into practical fisheries management advice

# Incorporating ecosystem considerations

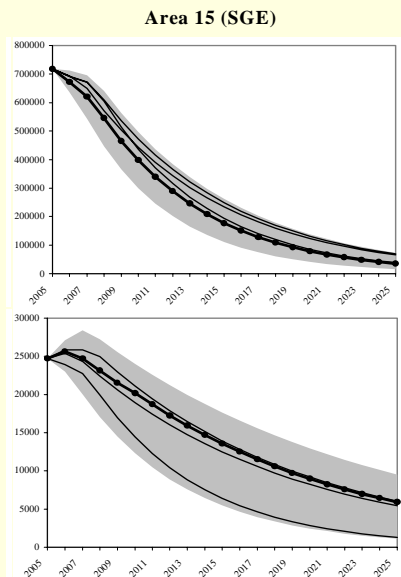
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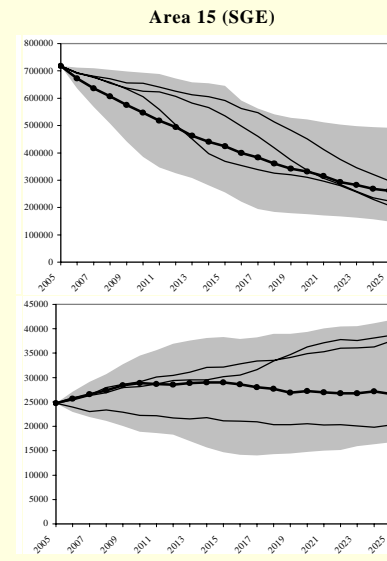
Ref: Plagányi, É.E., & Butterworth, D.S. 2006. A spatial multi-species operating model (SMOM) of krill-predator interactions in small-scale management units in the Scotia Sea. CCAMLR WG/EMM/06/

# Incorporating ecosystem considerations

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WITH FEEDBACK



MP used to compare different rules regarding the subdivision of the precautionary catch limit for krill among 15 small-scale management units (SSMUs) in the Scotia Sea

Ref: Plagányi, É.E., & Butterworth, D.S. 2006. A spatial multi-species operating model (SMOM) of krill-predator interactions in small-scale management units in the Scotia Sea. CCAMLR WG/EMM/06/

# Protocols for deviating from a MP

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- Concerns related to the overly rigid framework of the MP process
- Important to restrict deviations from MP output for a TAC recommendation, and bringing forward a MP review, to exceptional circumstances justified by compelling scientific evidence
- Desirably develop formal protocols pre-specifying the meta-rules to apply in such circumstances



# Summary re Innovations

- a) Joint two-species MPs – practical considerations
- b) A Reference Set = combination of operating models (weighted by their relative plausibilities) with tuning and evaluation re risk-related criteria evaluated across this set
- c) Donovan-Hammond approach allows greater catches in the short term conditional on research being implemented to resolve a key uncertainty
- d) Ecosystem considerations: 1. Developing appropriate robustness tests. 2. Ecosystem models as operating models to reflect alternative possibilities for the true underlying dynamics of a resource
- e) Need formal protocols to cover infrequent MP deviations



# Further Conclusions

- South Africa has achieved considerable success in putting the MP approach into practice, with *Operational* MPs used to regulate all three of the country's major fisheries
- Less haggling over annual TAC recommendations in scientific working group meetings
- Pre-specified TAC calculation rules: increase in transparency and improved understanding by all parties. Focus of research moved instead towards resolving important assessment uncertainties
- Responsible Minister has not deviated from any TAC recommendation arising out of a MP for all three of the major South African fisheries over last decade



Thank you!

