A quick intro to MSE

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MSE

- “use of computer simulation to develop robust management strategies that can meet multiple objectives” Kell et al, 2007
- Pioneered by IWC (Hammond, Donovan, Kirkwood)
- South Africa (Butterworth, De Oliveira)
- Australia (Punt, Smith, Dichmont, Polacheck)

Uncertainty

- SA generally assumes that
  - input data are appropriate and not biased
  - stock assessment models accurately reflect both population and fisheries dynamics
  - management measures are perfectly implemented
- Not always true!
- How robust is our advice to error & bias?

Error

- process error: caused by disregarding variability, temporal and spatial, in dynamic population and fisheries processes
- observation error: sampling error and measurement error
- estimation error: arising when estimating parameters of the models used in the assessment procedure
- model error: related to the ability of the model structure to capture the core of the system dynamics
- implementation error: where the effects of management actions may differ from those intended

Simulation

- Simulation to generate data, conditional on a set of assumptions about the dynamics to evaluate
  - accuracy and precision of estimates derived from stock assessment models
  - the robustness of those models to misspecification
  - sensitivity to changes in the input data.
- Errors are inter-dependent, cannot be decomposed

Elements of the fishery system

- Operating Model: the simulated reality
  - Natural population
  - Fishing operations
- Management Procedure
  - Provision of advice (SA)
  - Management decision (automated, HCR)
- Linked by observation model

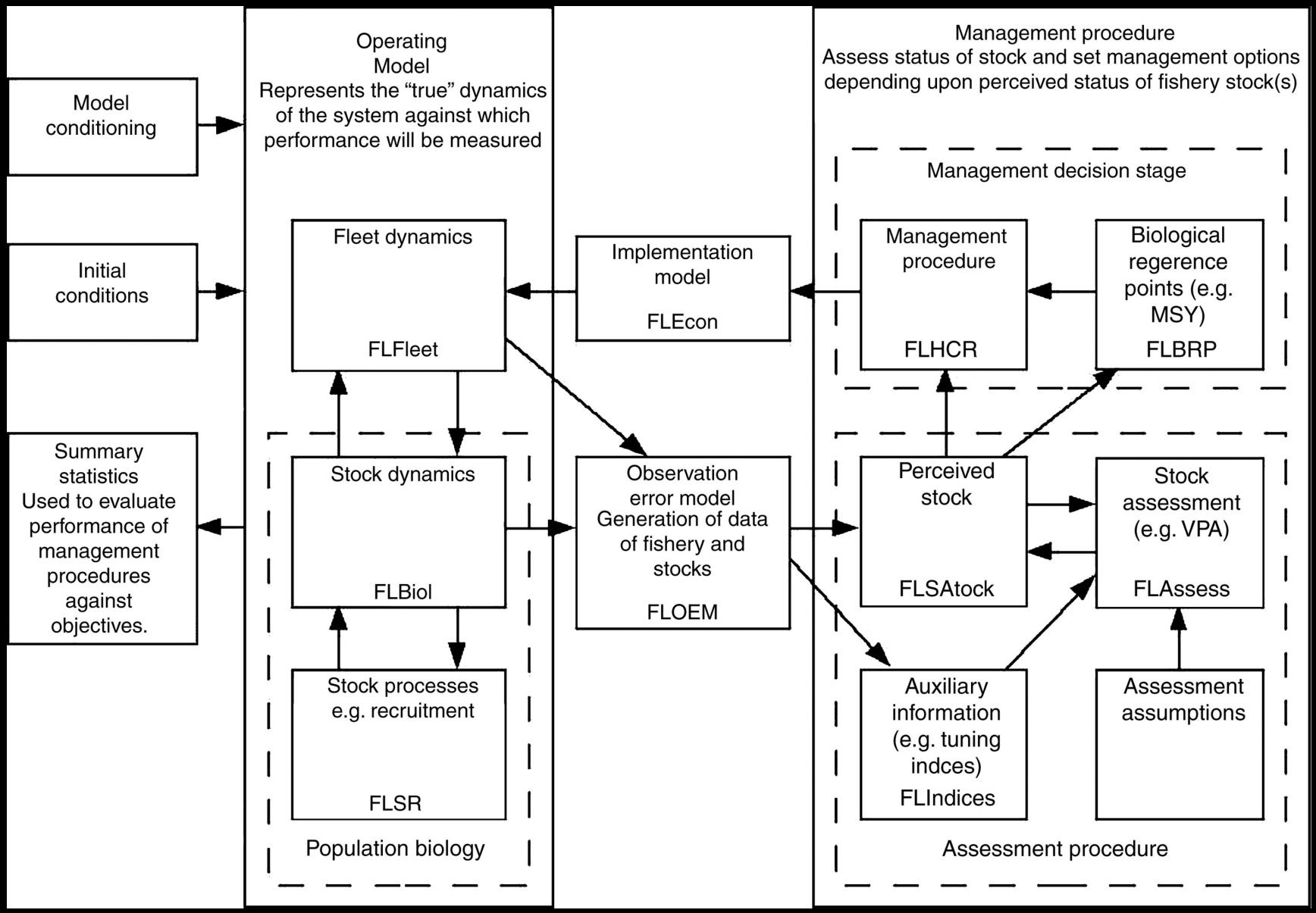
Conceptual framework

- Two systems: “true” and “observed”
- OM includes all available knowledge
  - full dynamics of the exploited populations,
  - Fisher behaviour in response to management
  - environmental conditions
  - Plus interactions
- greater level of complexity and knowledge than SA

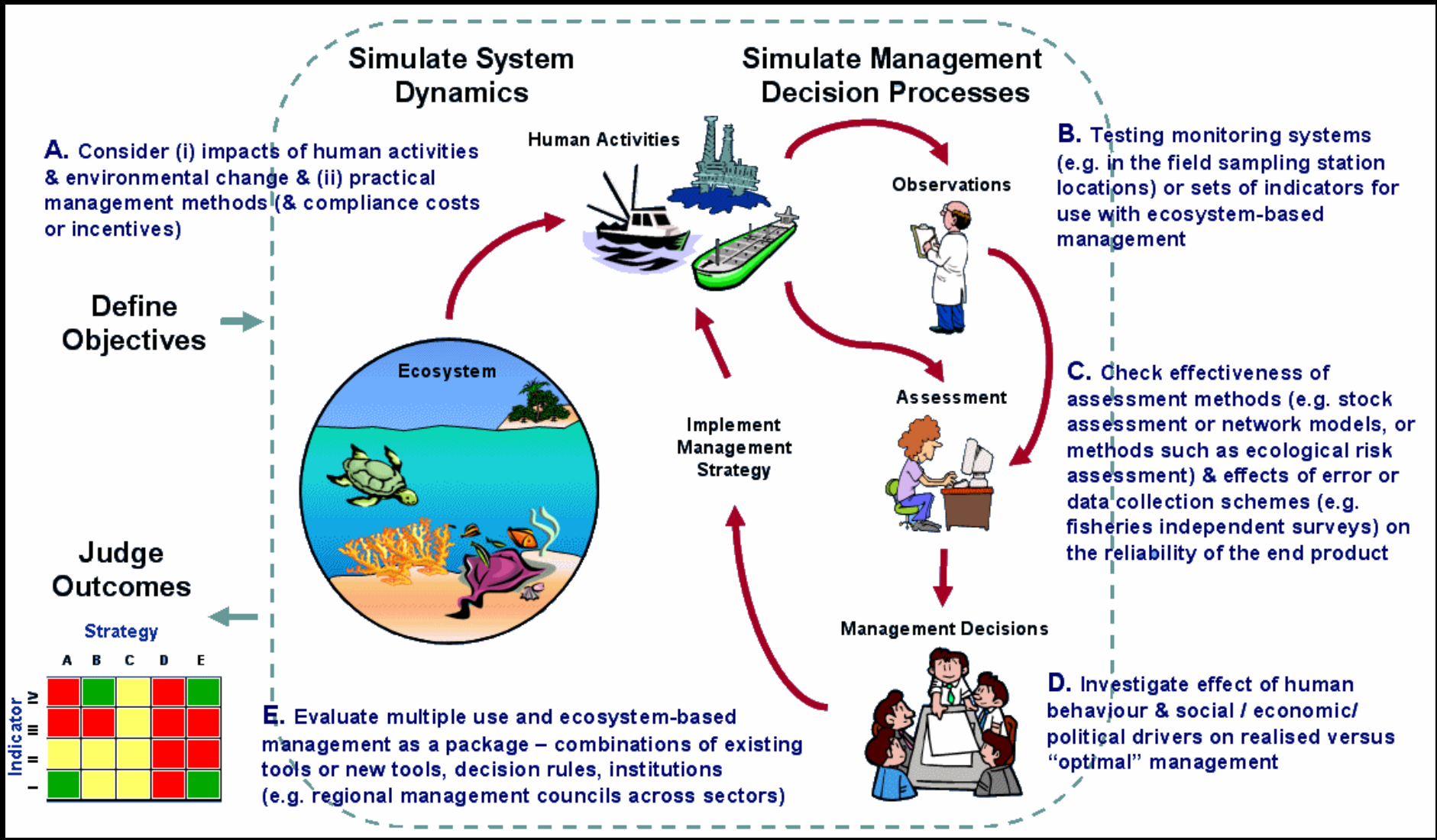
Conceptual framework

- MP: conventional process from data collection through stock assessment to management implementation
  - an observation model that simulates data collection
  - an assessment model
  - a predefined set of management actions according to some specified rules (HCR)
- Once implemented, management affects OM and MP

Conceptual framework



Conceptual framework



Development procedure

- Process can be difficult but also very fruitful
  - SBT, Kolody et al 2008
  - IWC, Donovan
- Likely to bring new data (surprises!)
- Important for acceptance of HCR algorithm
- Process needs as much effort as technical side
- Choose a good chair!

HCRs

- Generic HCRs to be tested first
  - Froese et al, 2010
- Accommodate industry/social concerns
- Easy to understand, felt to be fair
- Visualize expected results
- Explain divergences: simulated vs. reality

Performance statistics

- Agreed beforehand, difficult as not seen yet
- Cannot be changed afterwards
- Visualization of conflicting results
- Show ranges of uncertainty in results
- RISK

Performance statistics