An introduction to the evaluation of management procedures through simulation

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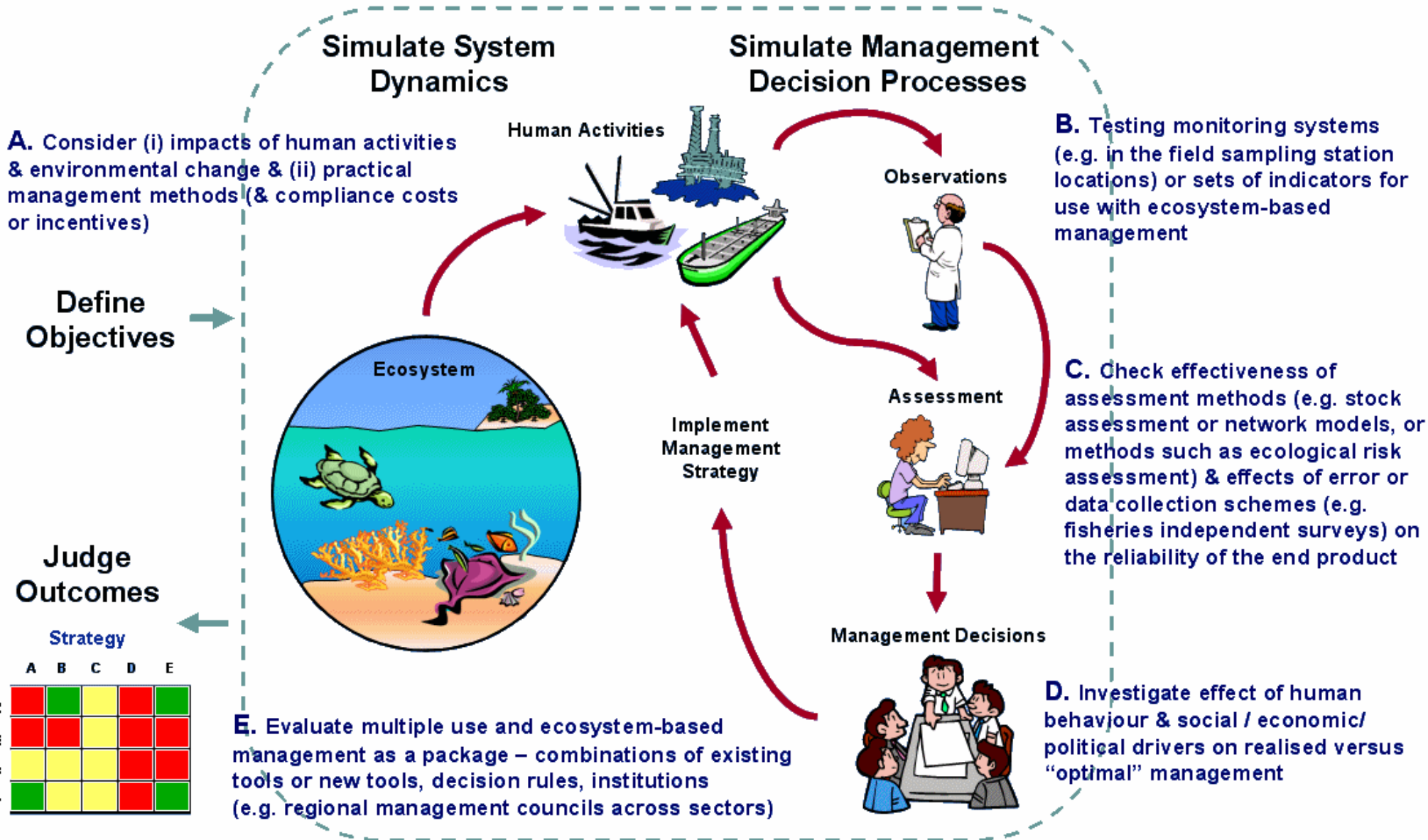
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Use of simulation tools to explore the robustness of management options to uncertainties in the system

Compare the evolution of "real" and perceived systems to quantify errors and biases

To do under so under a range of scenarios of uncertainty

To quantify the success at achieving pre-agreed objectives

Simulate System Dynamics

Simulate Management Decision Processes

A. Consider (i) impacts of human activities & environmental change & (ii) practical management methods (& compliance costs or incentives)

Human Activities

Observations

B. Testing monitoring systems (e.g. in the field sampling station locations) or sets of indicators for use with ecosystem-based management

Define Objectives

Ecosystem

Implement Management Strategy

Assessment

C. Check effectiveness of assessment methods (e.g. stock assessment or network models, or methods such as ecological risk assessment) & effects of error or data collection schemes (e.g. fisheries independent surveys) on the reliability of the end product

Judge Outcomes

Strategy

A B C D E

Indicator

Management Decisions

E. Evaluate multiple use and ecosystem-based management as a package – combinations of existing tools or new tools, decision rules, institutions (e.g. regional management councils across sectors)

D. Investigate effect of human behaviour & social / economic/ political drivers on realised versus "optimal" management

OMP: *Operational Management Procedure* **or**
MSE: *Management Strategy Evaluation*

Simulate the expected performance of a
    management plan given a set of observations,
    uncertainties and assumptions about the
    system.

* After Rademeyer et al., 2007

MP: *Management Procedure*

The combination of data collection, analysis (including or not an stock assessment), and decision rule that provides one or more management quantities (TAC, effort, …). Must be simulation tested to be robust to uncertainties.

HCR: *Harvest Control Rule*

An algorithm to propose or decide or the appropriate management action given the level of certain indicators, in order to achieve some pre-specified objectives.

OM: *Operating Model*

Statistical representation of the real system employed in the simulation trails to compare against how the system is perceived by the MP. Should incorporate our best knowledge and the key uncertainties, quantified as best as possible.

Conditioning

Process by which the OM is constructed, usually via an statistical procedure.

Management Objectives

Management objectives in terms of limits, targets, and accepted risks of exceeding them.

Based on reference points or indicators

Scientific Objectives

Develop a robust HCR, test influence of data or SA assumptions, evaluate value of information, ...

Performance targets

Agreed beforehand, linked to objectives

Minimum set of rules for HCR selection

Probability of being reached / exceeded

Operating Model

Existing SA

SA + extra information

Ad-hoc model with all available data

Process with increased complexity

Observation Error Model

What could be the essential elements?

- CPUE(s)
- Growth model thus CaA
- NC by certain fleets

Bias and error to consider

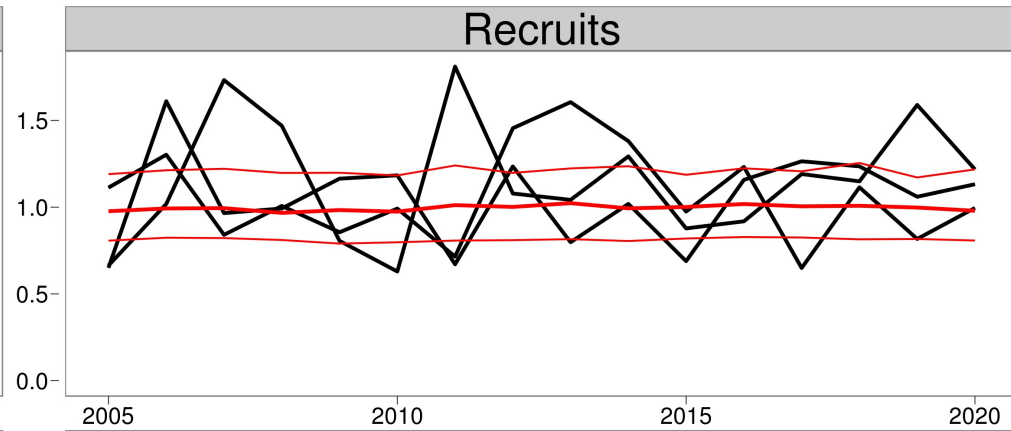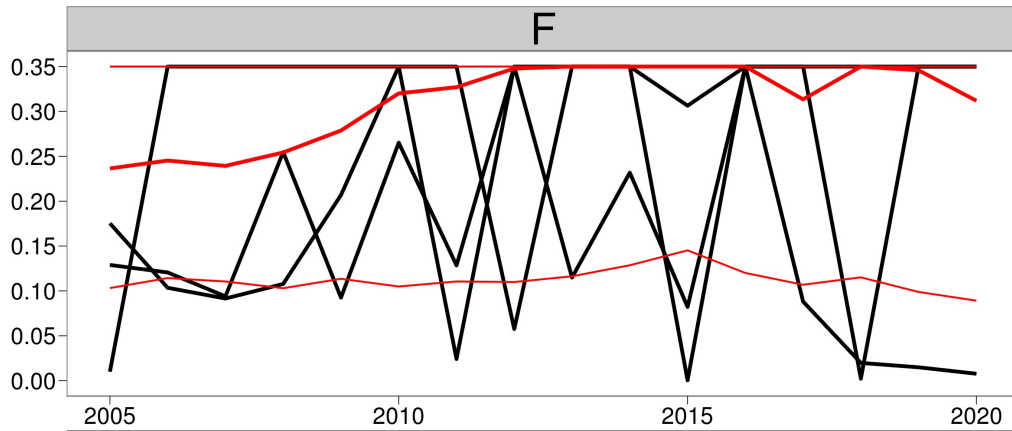## Identify where to focus efforts (data collection, monitoring)

Management Procedure

Stock assessment needs be run quickly

HCR must be in algorithmic form for full evaluation

Interactions between data and rules (e.g. tags)

MP vs OM
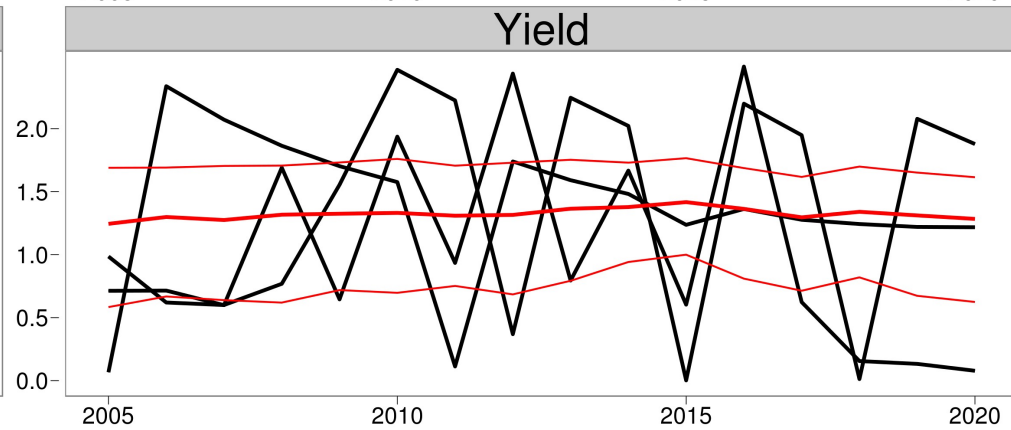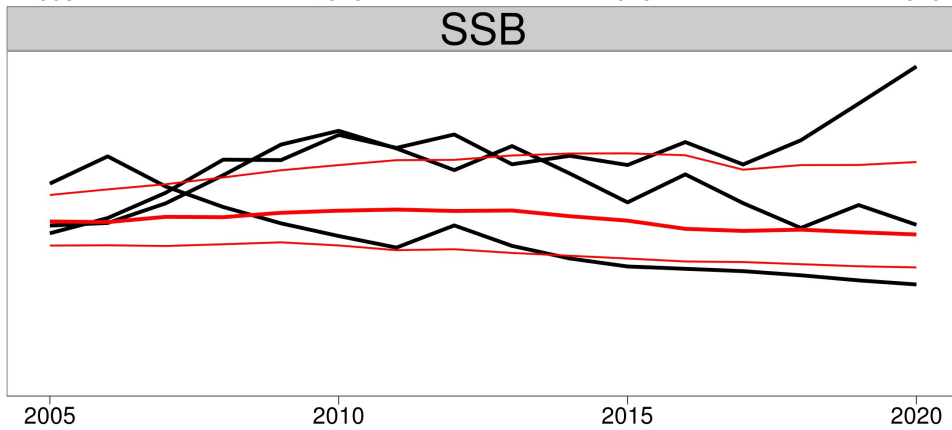
Setting limits and targets: precautionary approach

Setting objectives: risks

Agreeing performance measures: biological and/or economic

SC could start process and propose a trilateral workshop: scientists, managers, industry

Language(s): R/FLR + C/Cpp + F77/90

Coding style: Agree on guidelines

Collaboration tools: VCS, Wiki

VV&T procedures: Unit testing, simulated datasets

Development process: Central coder (gatekeeper)

Maintenance: Routine runs and reports, papers for meetings

Evaluate work already available

Is the technical know-how a limit?

Evaluate limit and target reference points with current models

Should economic issues be brought in? When?