Tools for credible decision making;
an analysis of successful tool application
in ecosystem based management.

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Tools for trade-off analysis in Ecosystem Based Management (EBM)

Atlantic Ocean Research Alliance (AORA) created a task group to improve our understanding of the process leading to successful development & uptake of tools in the EBM process.

USA, Canada & EU

The talk in a nutshell...

Concepts → Development best practice → Framework for analysis

Categories of tools → Case studies → Findings & summary
EBM & trade-offs

EBM recognizes the interconnections between the physical, biological, social (incl. cultural) & economic components of marine ecosystems.

**Trade-off** “A choice that involves losing one quality or service (of an ecosystem) in return for gaining another quality or service. Many decisions affecting ecosystems involve trade-offs, sometimes mainly in the long term.” TEEB (2010)

A portfolio of ecosystem, economic, social, & institutional management objectives exists in all jurisdictions.

Many tools have been developed to deal with the daunting complexity & breadth of trade-offs.
Best practice for developing tools for EBM

- **credible methods** to construct the evidence (documented, reviewed with broader social acceptance than required for journal publication)
- **legitimate process** of tool development as outcomes used in public decision-making, likely develop through co-creation/participation
- address **uncertainties** openly
- **realistic cost** of tool development & application
- **quality control** the process for use of the tool, incl. training of users
- ensure **socially accepted treatment** of data, data management & decision-making (FAIR principles, Aarhus Convention)
- **test the tool** in range of situations to ensure that it is robust & useful
Framework for analysis of use of tools

How to assess successful application of tools for EBM trade-off considerations?

A successful application of a tool would cover some elements of identification, evaluation, & presentation of trade-offs; evidence of the use of the tool in decision-making; & validation of the trade-offs as part of an iterative & adaptive process.
Types of tools considered:

Case studies of operational EBM tools were assessed using EBM-STAR from a range of **broader & specific** tools:

- Risk assessment
- Management strategy evaluation
- Multi-criteria decision making
- Ecosystem services framework
- Strategic environmental assessment
  - Conceptual modelling
  - Static spatial planning & evaluation tools
  - Models of intermediate complexity
  - Strategic simulation models
  - Bayesian belief networks
  - Dynamic spatial models
EBM-STAR applied to case studies, including:

Ecosystem Services Framework of Belize Coastal Zone Management Plan (InVEST)

Risk Assessment-Pathways of Effects of Anguniakvia Niqiqyuam Marine Protected Area Planning (risk assessment).

**Strategic Simulation Models (End-to-end models) of Mississippi River Hydrodynamic & Delta Management**

Dynamic spatial fisheries models to determine impacts of closed areas on species impacted by fisheries in the Adriatic

Multi-criteria Decision Making (MCDM) for Horseshoe crab fishery and Red Knot conservation.

**MSE to determine long term management targets for small pelagics**

**MICE to determine short term impact of advised catch levels on bycatch of porpoises**
Worked example.... Mississippi river hydrodynamic & delta management study (end to end models)

Suite of physical models (flow & sediment) coupled with habitat suitability models & food web models to allow stakeholders to explore choices on wetland morphology & salinity on the fisheries ecosystem (1º production, fish & mammals).

de Mutsert et al 2017 Ecological Modelling
Tools not applied uniformly across management objective pillars.

- many tools can potentially examine trade-offs between management objective pillars
- few operationally applied to social & even fewer to institutional objectives
- although many marine EBM trade-off decisions implicitly incorporate social & institutional objectives; the use of evidence base in those decisions, & actual decision making process is opaque & difficult to assess
- current examples of EBM offer little indication of explicit evidence use & transparent decision making for social & institutional management objectives (pillars)
Analysis hampered by paucity in reported use & validation

Analysing EBM-STAR elements of presentation, usage & informing decision making process, & validation of application of tools generally appears outside the primary research literature. Adds to opaque nature of the evidence base by which to assess success of tool application.

Confidential processes & implicit decision-making further prevent systematic assessment of success in opaque parts of EBM-STAR.
What have we learnt?

• Best practice for developing tools often not used
• Most AORA jurisdictions lack any national or international arena, or governance structure in which to use trade-off tools (regional – yes)
• Lack of incentive for validation of tools & models
• Tools differ between sectors & disciplines; integration of tools represents a major challenge
• Information on some objectives is usually not presented
• Many of the elements from EBM-STAR are outside current mechanisms for rewarding academic & institutional researchers
Conclusions

Much invested in developing tools for EBM across AORA jurisdictions & host of tools exist to support trade-off analysis (assess state & explore possible options & consequences of decisions).

Only a proportion of the tools have been operationally applied/used.

Provision of tools for societal decision-making requires that researchers operate beyond the traditional boundaries of their training.

Workshop could not analyse the success rate of tool application of tools for trade-offs in marine EBM.
Recommendations

• Adapt tool development to ensure that social & institutional trade-offs become as explicit as ecosystem & economic trade-offs.

• Make data & information from the presentation, utilization, & validation elements of EBM-STAR available to improve advice

• Perform validation element of EBM-STAR after use, to demonstrate robustness to limited understanding of the system
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