



Atlantis Course Universidad de Concepción

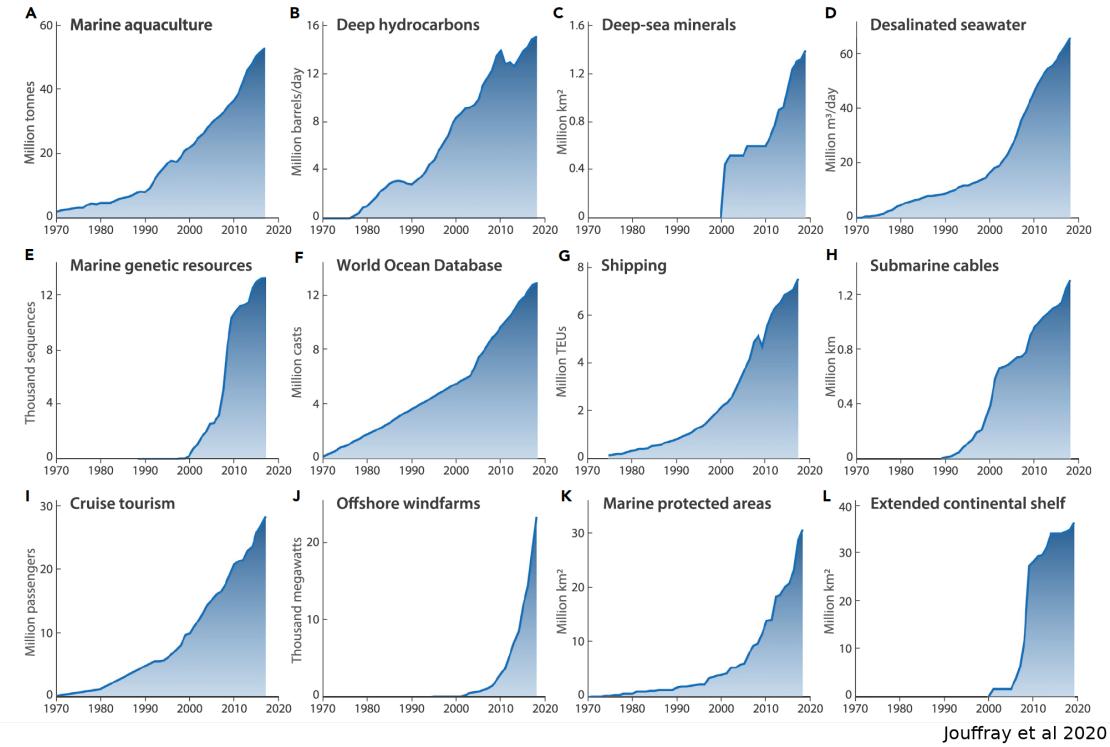
Day 1 - Ecosystem models and EBFM

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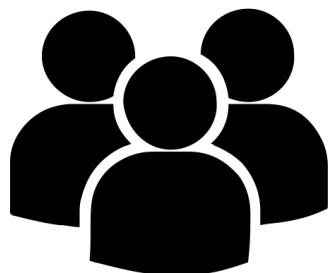
Marine Ecosystems under pressure



Value of Marine Ecosystems



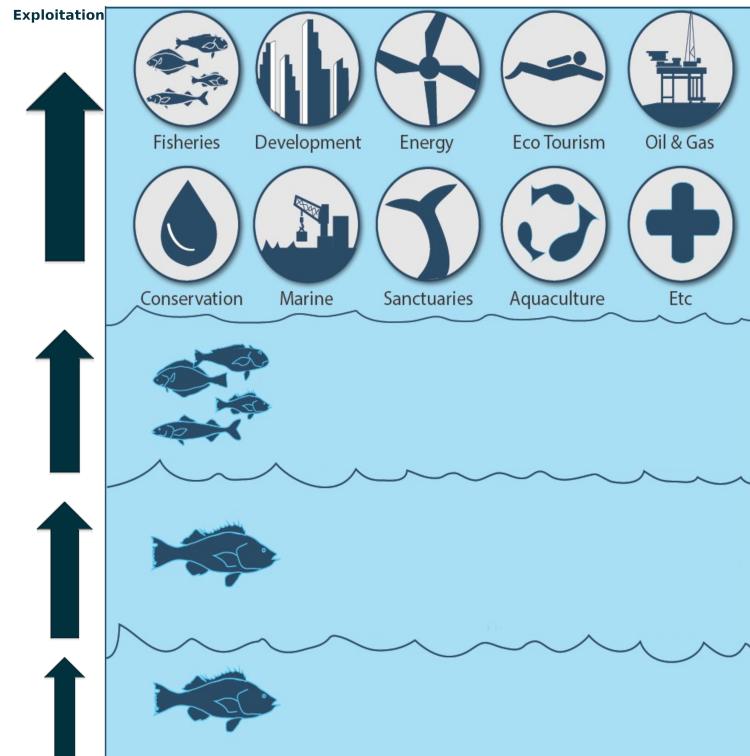
Value of Marine Ecosystems



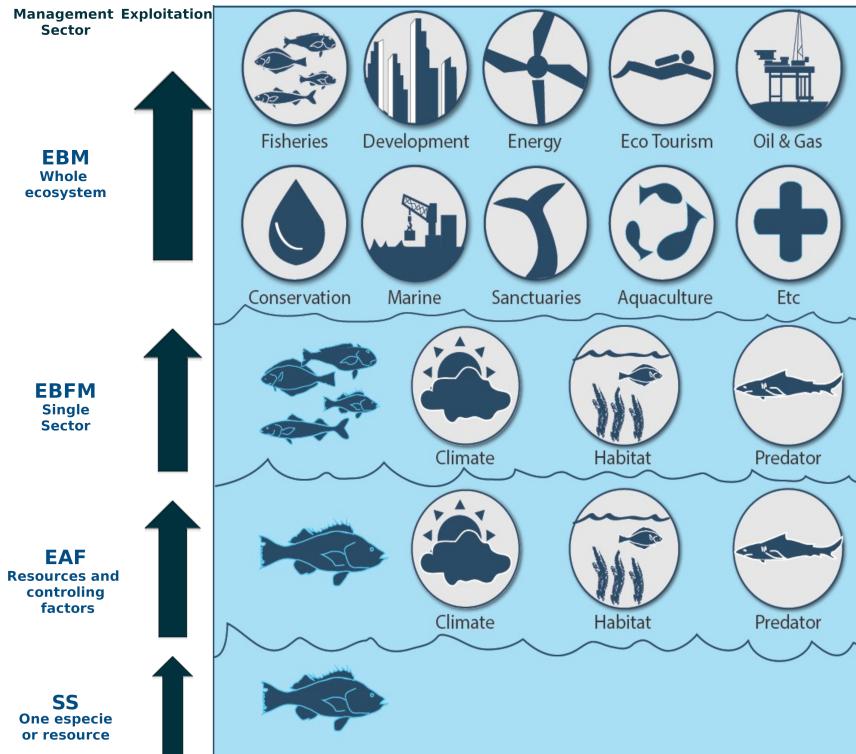
Value of Marine Ecosystems



Ecosystem management



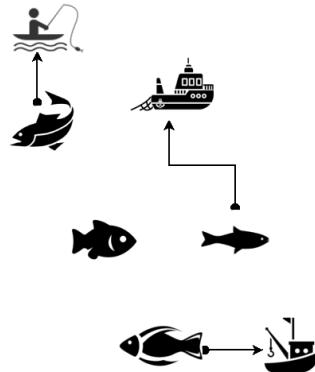
Ecosystem management



Management Objective

- High level
 - Preserve the structure and function of the ecosystem
 - Management goals are a matter of social choice
- Operational
 - MSY
 - Avoid overfishing

Single species



Management Objective

- High level

Preserve the structure and function of the ecosystem

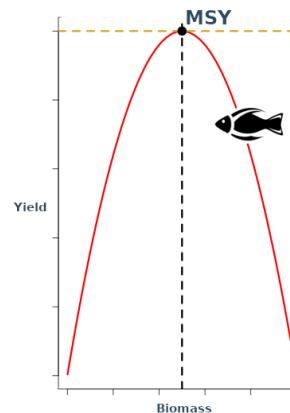
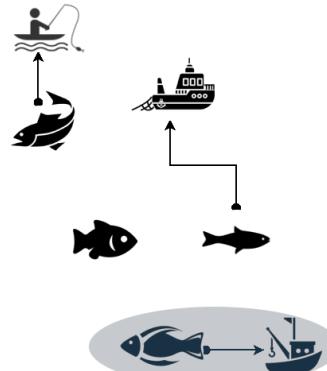
Management goals are a matter of social choice

- Operational

MSY

Avoid overfishing

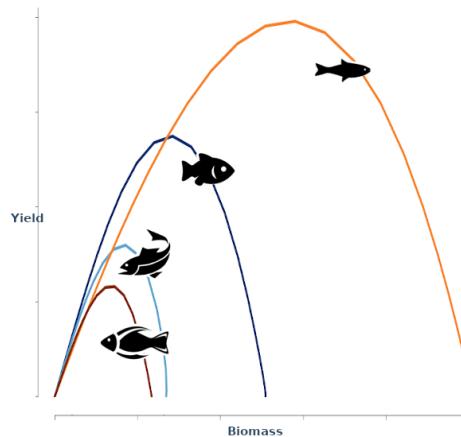
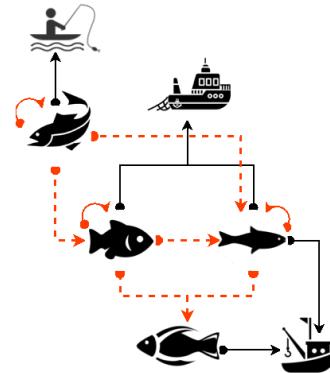
Single species



Management Objective

- High level
 - Preserve the structure and function of the ecosystem
 - Management goals are a matter of social choice
- Operational
 - MSY
 - Avoid overfishing

Multi-fleet & Multi-species



Understanding the ecosystem



Unknown future



Unknown future: looking at the past



Highly sophisticated models



Highly sophisticated models : looking the entire picture

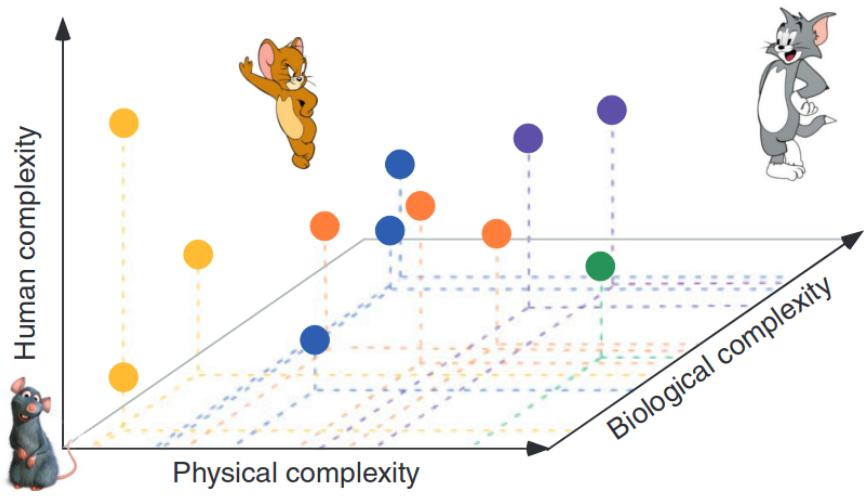


Highly sophisticated models : looking the entire picture



Supporting tools for EBM

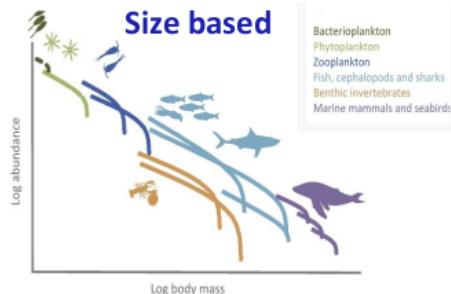
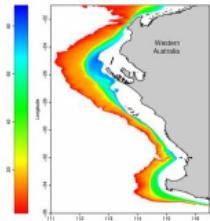
- RATS models
 - Relegate All Top Species
- MICE models
 - Models of Intermediate Complexity for Ecosystem assessments
- CATS models
 - Complex Assess Tools



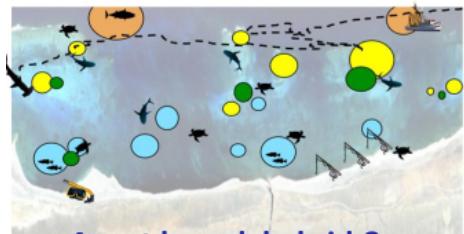
Plaganyi et al. 2011 Mar. Freshw. Res.

Uses of Marine ecosystems

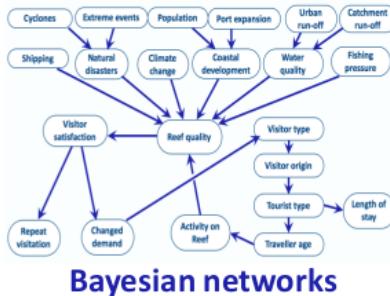
Species distributions



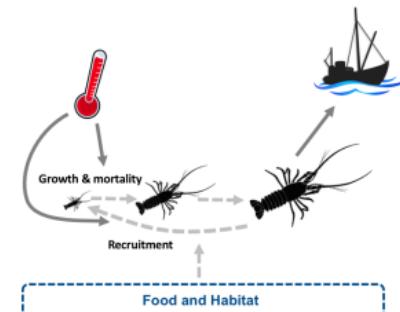
Trophic (EwE)



Agent based, hybrid & end-to-end models



Bayesian networks



Minimum realistic (MICE)

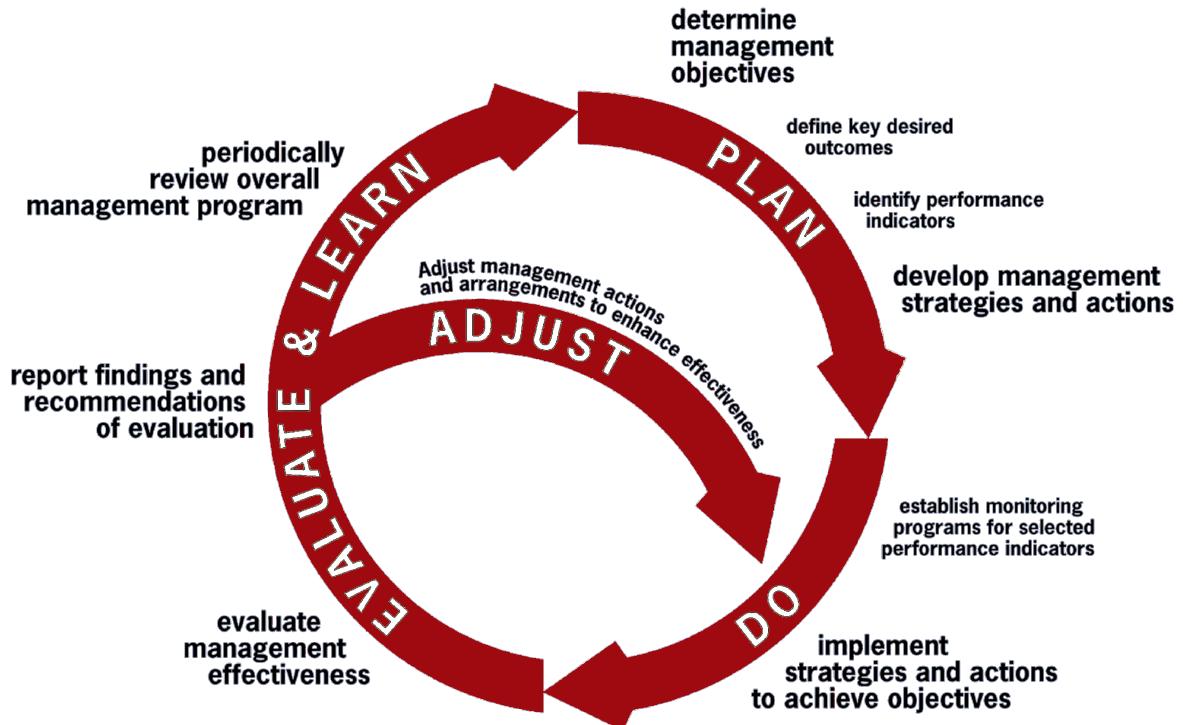
Christensen & Walters 2004, Travers *et al.* 2008, Fulton 2010, Dunstan & Foster 2011, Blanchard *et al.* 2017, Anthony *et al.* 2013, WWF

Purpose What-if sandbox

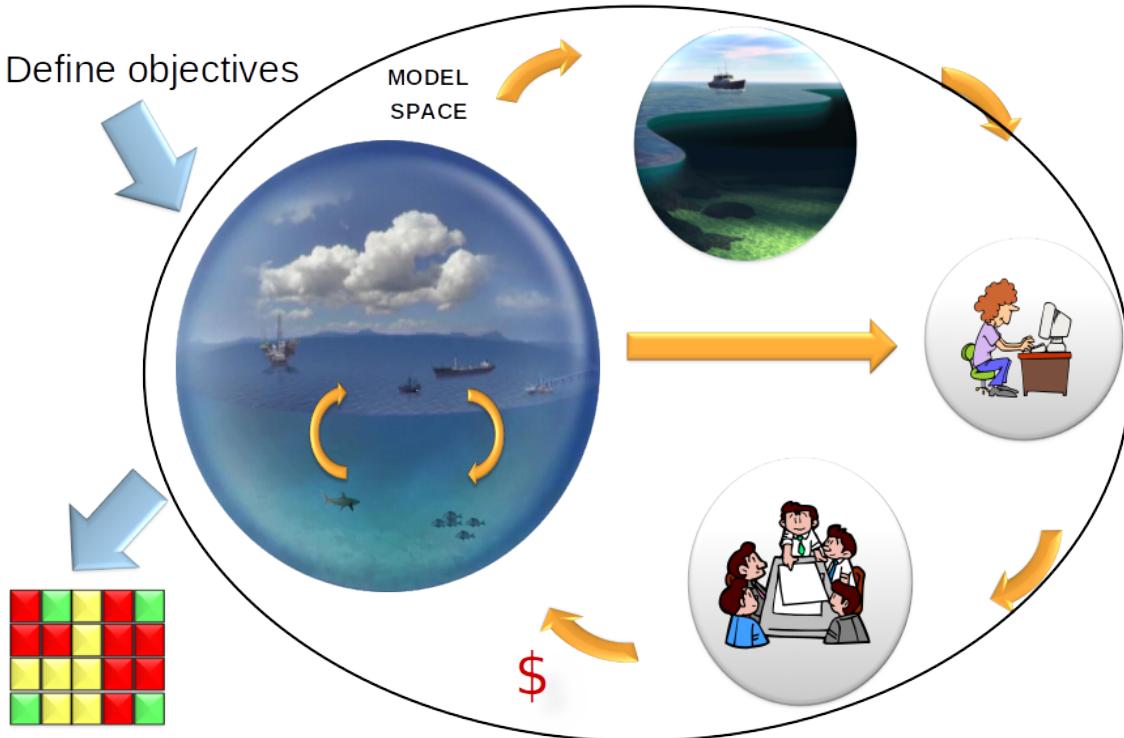
- model complexity
- ecological understanding
- whole of system understanding
 - fisheries
 - management systems
 - social and economic behaviour
 - cumulative (climate) impacts



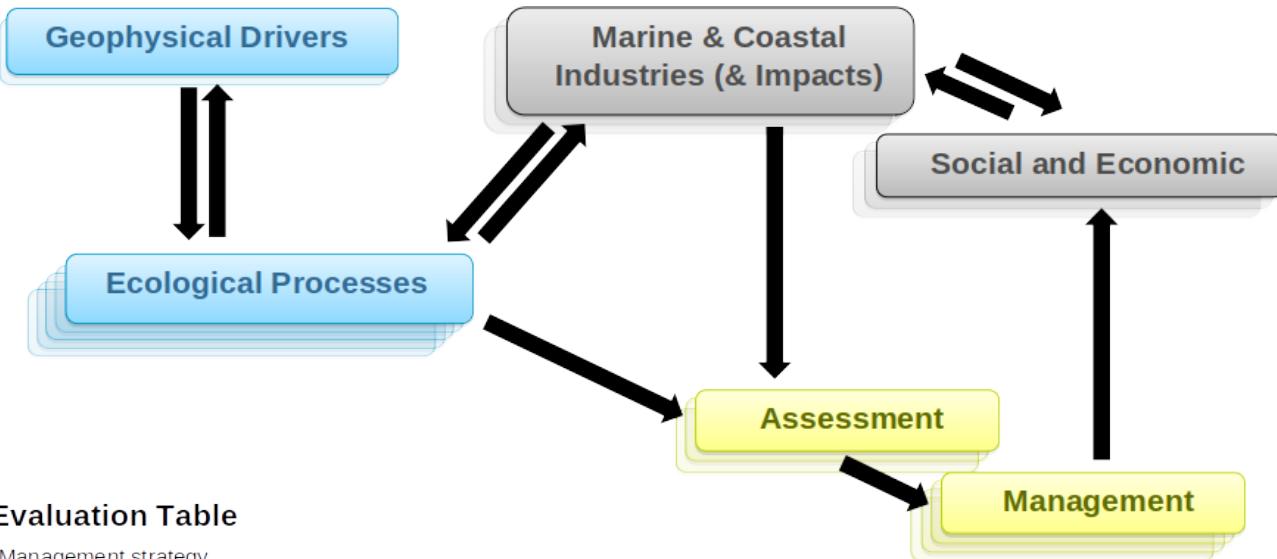
Adaptive Management Cycle



Playout Alternative Futures



Management Strategy Evaluation



Evaluation Table

Management strategy

Objectives						
	Red	Green	Yellow	Red	Green	
	Red	Red	Yellow	Red	Red	
	Yellow	Yellow	Yellow	Red	Red	
	Green	Yellow	Red	Green		

Management Strategy Evaluation

Geophysical Drivers

Climate
Oceanography
Bathymetry
Sediment Process

Ecological Processes

Nutrient cycles
Oxygen and pH
Habitats
Production
Food webs (*Biodiversity*)
Feeding and growth
Waste
Mortality
Movement
Reproduction
Evolution

Marine & Coastal Industries (& Impacts)

Recreational
Residential
Urban
Fisheries
Tourism
Oil and gas
Ports and shipping
Catchment
Agriculture

Social and Economic

Social networks
Attitudes
Markets
Costs
Investment
Revenue
Broader economy
Behaviour & decisions

Assessment

Monitoring
Estimation

Management

Control Rules
Regulation (input & output & spatial)

Data, data ... it's always about data!



Thébaud *et al.* 2017. ICES Jour. Mar. Sci.

Thank You

Ocean & Atmosphere

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