Australian experiences with modelling multiple management objectives in fisheries

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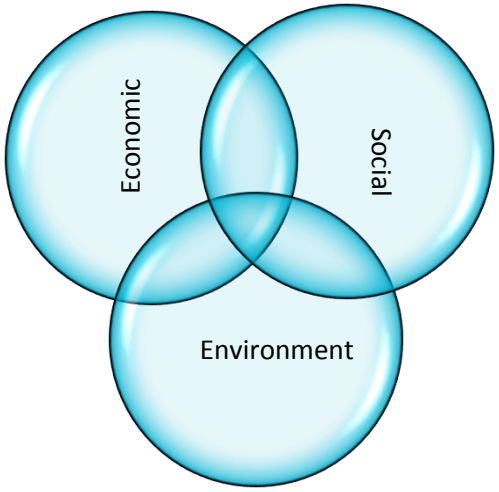
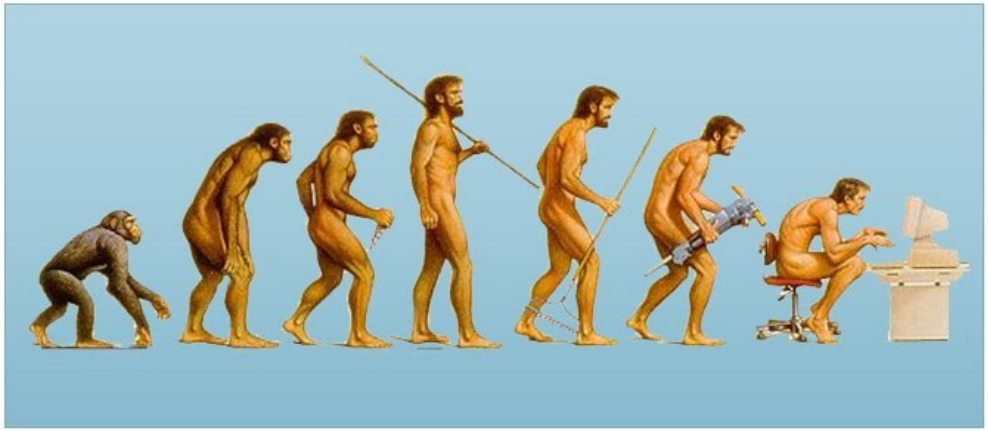
Overview



- The evolution of fisheries objectives
  - Shift from MSY ⇒ MEY ⇒ OY ⇒ MSocY ⇒?
- So what are management objectives?
- Evaluating multiple objectives using models – some examples from Australia



Objectives of fisheries management

Protection of stocks key focus
- concepts of MSY and MEY developed

Development of surplus production models
- MSY and MEY identifiable targets
    - Dominance of MSY
- Some concerns about trade-offs between catch and employment

Ecosystem based fisheries management
- Ecologically sustainable development
- Environmental, social and economic objectives

What are the main objectives?

- Economic
  - Vessel/fleet profitability
  - Market related objectives
  - Processor/suppliers?
- Environmental
  - Sustainability of commercial stocks
  - Bycatch
    - Sustainability of non-target stocks
  - Habitat impacts
- Social
  - Employment in the fishing sector
  - Associated onshore employment
  - Equitable access to the resource
  - Minimise conflicts with competing users
  - Respect customary fishing
  - Enhance community resilience
  - Improve quality of life in coastal communities

Others?

- Political
- Food security
- Foreign exchange generation
- Tourism

- Minimum sustainable whinge
  - avoiding all really unpleasant situations is more important than achieving the absolute maximum of a few

- "Maximum social yield"
  - Tony Charles: an effort level that maximises the full set of objectives (social, economic and environmental) taking into account their relative weights

Australian objectives

- Two levels of fisheries management
  - Commonwealth (1/3 by value)
  - State (2/3 by value)

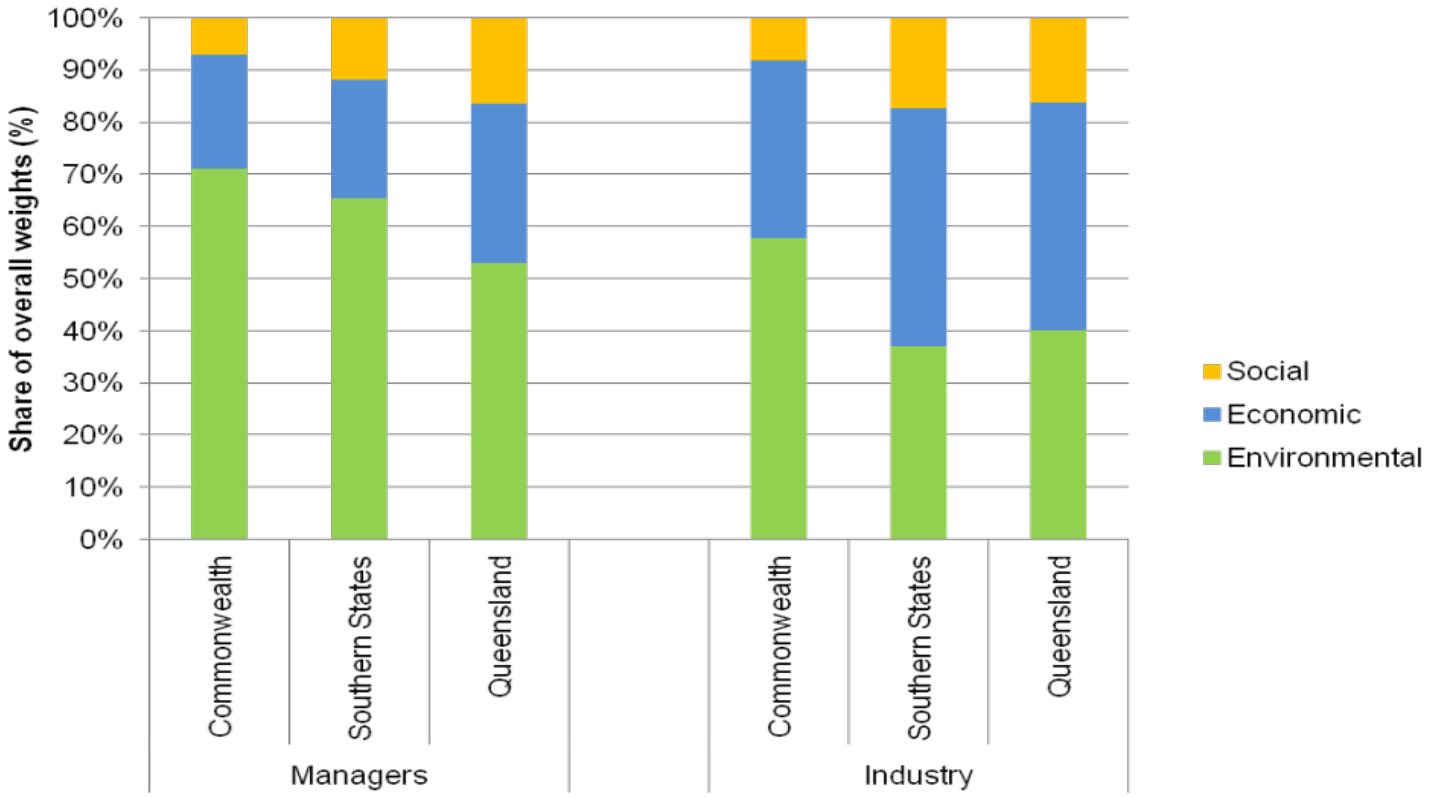
- Maximising net economic returns main objective in Commonwealth fisheries Act
  - MEY target
  - Resource sustainability

  ➢ No explicit social objective

- State fisheries
  - Varies state by state
  - Most States' fisheries policies include economic and social considerations with resource sustainability as key focus

- All fisheries covered by other environmental legislation
  - E.g. endangered species

Objective importance in Australia



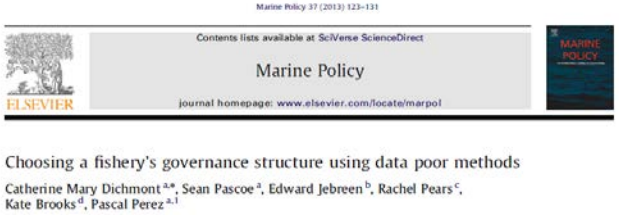
Incorporating multiple objectives in models

Queensland east coast trawl fishery

- State managed trawl fishery
  - Several prawn species; Scallops; Bugs
  - Managed by effort units (transferable)
    - Around one third effort units unused
- Relatively data poor
  - No ongoing stock assessments or models
    - Some evidence that stocks around MSY
  - Little economic information
    - Anecdotal evidence that profitability very low
    - Value of effort units negligible and no real trade
- Management plan needed to be reviewed
  - Fuzzy economic, social and environmental objectives in policy needed to be implemented

Approach adopted

- Qualitative based approach
  - Deliberative
  - Quantitative scores
- Determine set of operational objectives
  - Social, economic and environmental
  - Broad range of stakeholders (expert group workshop)
- Determined set of potential management strategies
  - Smaller expert group



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Choosing a fishery's governance structure using data poor methods

Catherine Mary Dichmont [a,*], Sean Pascoe [a], Edward Jebreen [b], Rachel Pears [c], Kate Brooks [d], Pascal Perez [a,1]

- Determined objective weightings
  - Broad range of stakeholders - survey
- Determined expectations about how objectives affected by each strategy
  - Expert group/workshop

Fishery as a whole	Modified Status Quo	Decrement -ation system	Separate regions	Sector access levies	Confidence (score 1-5)
	Score -3 to 3				
1.0 Maximise economic performance of the East Coast Trawl fishery					
1.1 Maximise value of tradable units					
1.2 Maximise industry profits					
1.2.1 Minimise annual fixed and variable fishing costs					
1.2.2 Improve product prices					
1.2.2.1 Improve product quality (to improve product price)					
1.2.2.2 Maintain and improve market access (to improve product price)					
1.2.3 Maximise catch rates (e.g. catch per day)					
2.0 Simplify and improve management structures					
2.1 Enhance opportunites for co-management					
2.1.1 Foster resource stewardship					
2.1.2 Strengthen partnerships (e.g. between industry and government and within industry)					
2.2 Minimise DEEDI management costs					
2.2.1 Ensure management strategies have low compliance risk					
2.2.2 Minimise other management costs					
2.3 Simplify management					
2.3.1 Minimise legislation volume and complexity					
2.3.2 Maximise operational and administrative flexibility					
3.0 Maximise social outcomes					
3.1 Maximise employment					
3.1.1 Maximise employment in the fishing sector (e.g. crew, skippers etc)					
3.1.2 Maximise associated onshore employment (e.g. in processing or sectors suppling the fishing industry)					
3.2 Ensure equity					
3.2.1 Ensure equitable access to resources					
3.2.2 Minimise conflicts with competing users (e.g. other gears, recreational fisheries, traditional fisheries)					
3.2.3 Respect customary fishing (e.g. fishing activity that has a long social history in an area)					
3.3 Maximise other social benefits to your local community from the use of the resource					
3.3.1 Enhance community resilience (the ability of the community to adapt to change)					
3.3.2 Improve quality of life in coastal communites (includes health and safety as well as general quality of life)					
4.0 Ensure sustainability					
4.1 Ensure harvested resource sustainablity (commercial and recreational fisheries resources)					
4.2 Ensure long term ecosystem resilience					
4.2.1 Minimise bycatch (TEP species, other commerical and non-commerical species)					
4.2.2 Maximise productive area of habitat (e.g. reduce area trawled, spatial concentration of effort)					
4.2.3 Minimise impacts of fishing on biodiversity and ecosystem function					
4.3 Minimise pollution and carbon footprint of the industry					

Management impact

Scale	Meaning
3	Considerably better than current situation
2	Moderately better than current situation
1	Slightly better than current situation
0	Same as current situation
-1	Slightly worse than current situation
-2	Moderately worse than current situation
-3	Considerably worse than current situation

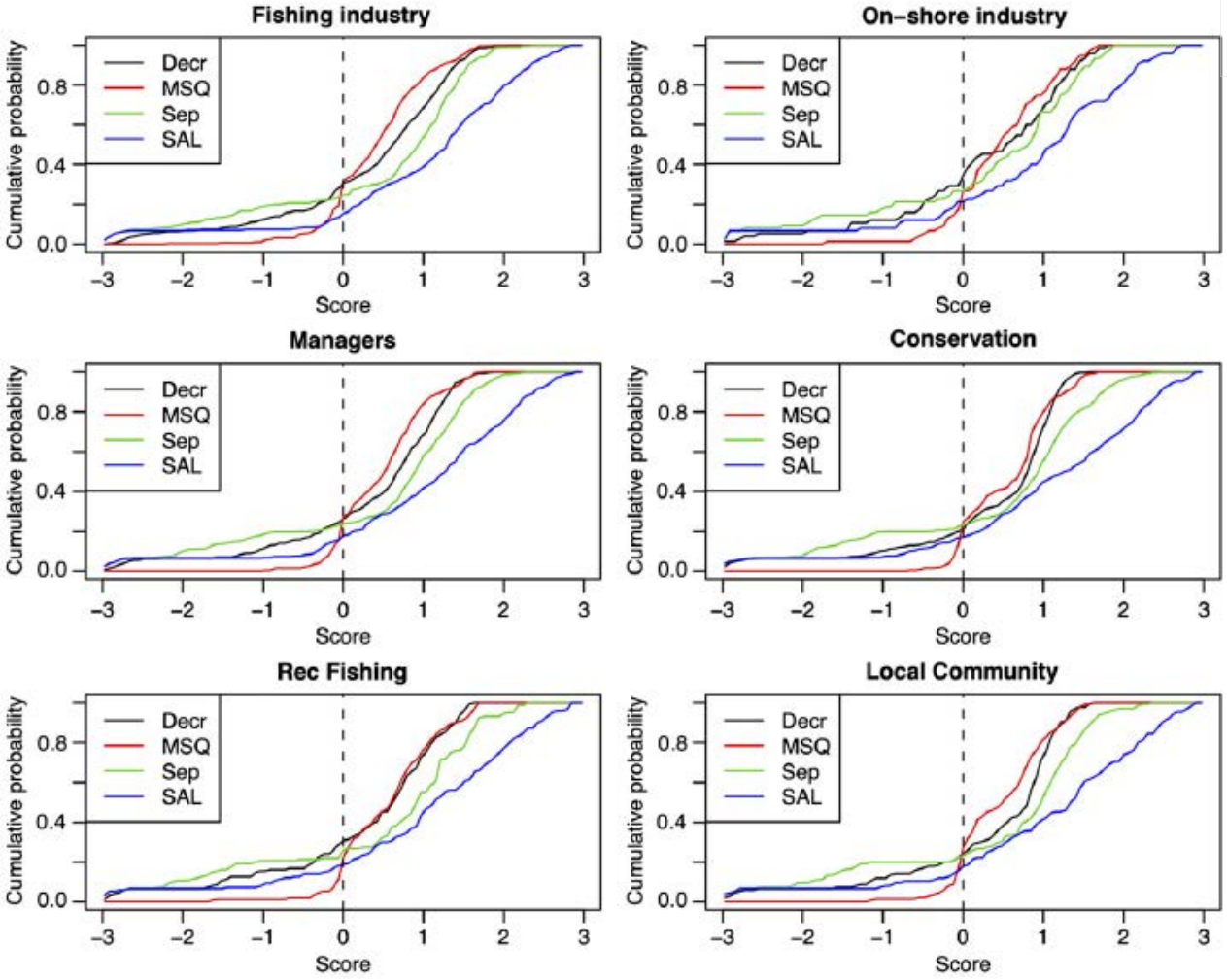
Confidence

Scale	Meaning
1	Very unsure
2	Fairly uncertain
3	Moderately certain
4	Fairly certain
5	Certain

- Combined weights and outcomes to estimate score for each optior

Outcomes

Queensland East Coast Prawn Fishery
Northern Territory
Queensland
Western Australia
South Australia
New South Wales
Victoria
Tasmania

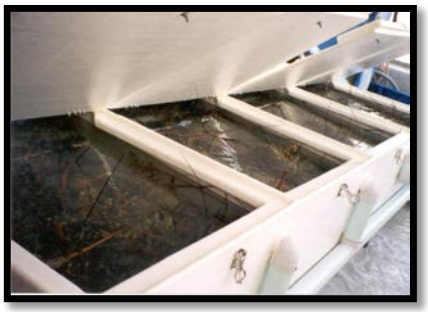

Fishing industry
On−shore industry
Managers
Conservation
Rec Fishing
Local Community
Decr
MSQ
Sep
SAL
Cumulative probability
Score
0.0
0.4
0.8
−3
−2
−1
0
1
2
3

Torres Strait Rock Lobster

- Complex fishery
  - International shared stocks with PNG
- Treaty establishing the joint management of the area has an explicit and dominant social objective
  - ‘‘to acknowledge and protect the traditional way of life and livelihood of the traditional inhabitants including their traditional fishing and free movement’’
- Other social objectives include
  - to increase participation in the fishery by the islander community;
  - to maintain community coherence, and
  - to ensure equity in access for the different islands
- Also a commercial non-islander fleet
  - Key objective is to maximise net economic returns (MEY)
  - Own the infrastructure that enables live export of all the output from the fishery

Indigenous Fishers
- Shore based
- ~ 400 fishers

Non-indigenous Fishers
- Vessel based
- 13 licensed vessels (1-7 tenders)



Modelling challenge

- Determine which management approaches will best satisfy the objectives of the different groups concerned
- Mix of data rich and data poor components
  - Well established stock assessment models of the fishery
    - Fishery-independent surveys provide key model inputs
    - Age-structured Production Model
    - Spatial extension
  - Used as the basis of a bioeconomic model to assess economic and resource outcomes
  - No established means of assessing social outcomes and interactions
    - e.g. drivers of participation

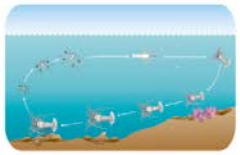
Composite modelling approach

Social analyses

typology

Bayesian network

Production function



Spatial Operating Model:
Biological population model*
(*inputs: surveys, catch/effort data, life history data)

effort by sector

Data Envelopment Analysis

Cost structure

- employment
- new entrants
- spatial localised effects

Economic sub-models:
- Profit
- Supply chain

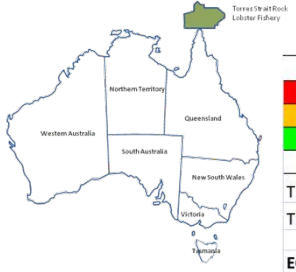
Socio-cultural
Equity
Consistent with custom
New entrants

Biological
Stock status
Localised depletion
Risk to resource

Economic
Profit by subsector
Employment
Value added

EXAMPLE PERFORMANCE INDICATORS

Outcomes



- Use of traffic light approach
  - Improvement or otherwise in each objective or "indicator of interest" identified visually
- No overall aggregation
  - Even at main objective level (e.g. social, economic, environmental)
  - No weightings of objectives undertaken
  - Decision as to which is best left to decision makers through further negotiations
    - Model provided a transparent overview of potential trade-offs

	Strategy:	A1	A2	A3	A7	A8	A9	A1-S1
negative impact		TIB Olympic	TIB Community	TIB-Hybrid	TIB Olympic	TIB Community	TIB-Hybrid	TIB Olympic_S1
neutral impact	TIB management approach							
positive impact	TIB Allocation	53%	53%	53%	70%	70%	70%	53% no CDEP
no information available	**ECONOMIC indicators**							
	Catch (total) (t)							
	TVH							
	TIB - active part time fishers							
	TIB - full time fishers							
	TIB - casual fishers							
	Papua New Guinea							
	East Coast							
	Profit of the fishery							
	TVH profit							
	TIB -full time (Returns Owner Operator Labour)							
	TIB -active part time (Returns Owner Operator Labour)							
	TIB - casual (Returns)							
	Employment (full time sea based)							
	TVH							
	TIB - active part time fishers							
	TIB - full time fishers							
	TVH (Islanders only)							
	Value added							
	SOCIO-CULTURAL indicators							
	Potential: fulltime vs. part-time employment							
	Potential for new and young Islanders to enter the fishery							
	Island custom (Traditional-, cultural-, and casual fishing)							
	Conflict between community; individuals and families (community coherence)							
	Equity – fair access for all Islanders							
	Race to fish - unequal distributional effect							
	Perceived change from current management situation (Management complexity)							
	Closely resembles sea country (communities have own spatial management)							
	Sense of self-determination / level of control							
	BIOLOGICAL indicators							
	Stock status (Spawning biomass 2031/2011)							
	Risk to resource (percentage of runs falling below limit reference point in projection)							
	Status of East Coast stock							
	Status of Papua New Guinea fishery							
	Risk of local depletion							

Key issues

- To aggregate or not to aggregate?
  - Useful for QECT case as able to identify an outcome that was "best" for everyone (even if for different reasons)
  - Not considered appropriate for TSRL
- Who's objectives?
  - Range and importance of objectives differs by stakeholder group
  - No universal set of social, economic and environmental objectives
- Difficulty in quantifying fundamentally qualitative objectives
  - Especially social objectives
  - Different approaches used in each case study based around what would be most acceptable to the stakeholders

Why bother?

Stakeholder buy-in is fundamental to any management plan being successful!