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Maximising yield of fisheries while balancing ecosystem, economic and social concerns

A framework for managing fisheries with multiple economic, ecosystem and social objectives

John Mumford, Anna Rindorf, David Reid, Axel Rossberg, Christine Röckmann, Alexander Kempf, George Tserpes, Christos Maravelias, Christopher C E Hopkins, Maria Hadjimichael

The MSY Problem

- Narrow focus on yield is outdated
  - But it is good ecological common sense
- How to address multiple objectives?
  - How to articulate objectives?
  - Inclusion of a broad set of stakeholders?
- Needs Good Practice: science, governance, rights
  - Well-communicated, comprehensive policies employing science in structured systems
  - Predictable staged rules, durable ownership and co-management

Operational framework

Problem framing — Objectives not currently met

- Identify **objectives, priorities and acceptance criteria** for all stakeholders in relation to MSY
- Identify possible **trade-offs**
- Identify governance and institutional settings

Options — Agreed dimensions for decisions

Implementation — Trade-offs addressed

Evaluation — Outcomes that meet wider aims

Deliverable 1.3 **Final operational framework for the attainment of MSY while respecting constraints** Dave Reid et al.

Objectives and Implementation

- Faroe Islands Fisheries Governance System
  - Share allocation, fleet segmentation, fleet zonation, limited entry licensing, limiting discards, technical conservation measures, acceptance and compliance
- Governance System for the Australian Northern Prawn Fishery
  - Transferrable allocation, effort/capacity control, restricted entry, accountability measures, acceptance and compliance, acceptance of science, economic considerations, diverse governance, precautionary approach, MEY targets and MSY limits, socio-economic/environmental impacts and MSE, certification

Deliverable D1.2 **Global definitions of MSY variants and trade-offs, regionally relevant trade-offs, constraints and management measures in an European and global context and a draft operational framework**
Chris Hopkins, Troels Hegland, Doug Wilson and Maria Hadjimichael

Objectives and Implementation

- Fisheries Governance System for Alaska Pollock
  - Defined objectives, stakeholder inclusive governance council, IFQs and catch shares, effort/capacity control, limiting bycatch, accountability measures, acceptance and compliance, acceptance of science, economic considerations, precautionary approach, MSY limits, certification

Deliverable D1.2 **Global definitions of MSY variants and trade-offs, regionally relevant trade-offs, constraints and management measures in an European and global context and a draft operational framework**
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Good practice - science

- Science-based management
- Benchmark performance
- Real-time monitoring
- Document and communicate rationale and performance
- Full catch retention
- Monitor effort creep

Good practice – governance and rights

- Clear comprehensible policies
- Acceptance of policies and management principles essential for compliance
- Co-management and cost recovery
- Self-regulation as part of management
- Fisheries-specific rules
- Staged control rule steps
- Durable rights
- Specific rights for specific social targets

MSY Variants Ranked

MSY Variant	Baltic	Mediterranean	North Sea	Western Waters	Widely Ranging	Max	Min	Mean	Range
1 Maximise inclusive governance	-	2	1	3	2	3	1	2.0	2
2 Maximise value of key commercial species	-	5	3	1	-	5	1	3.0	4
3 Maximise Gross Value Added	1	3	9	8	-	9	1	5.3	8
4 Maximise yield in value	6	7	5	2	8	8	2	5.6	6
5 Maximise Net Present Value	7	1	8	7	9	9	1	6.4	8
6 Maximise yield in tonnes of key commercial species	-	5	6	10	-	10	5	7.0	5
7 Minimise risk of falling outside constraints	1	13	-	6	12	13	1	8.0	12
8 Maximise Resource Rent	1	3	19	9	-	19	1	8.0	18
9 Maximise health benefit/CO_2	-	-	-	-	9	9	9	9.0	0
10 Maximise yield in tonnes	9	9	12	13	4	13	4	9.4	9
11 Maximise present yield for human consumption	8	-	-	11	-	11	8	9.5	3
12 Maximise useful knowledge	-	8	13	12	5	13	5	9.5	8
13 Maximise willingness to invest in the future fisheries	12	-	15	4	7	15	4	9.5	11
14 Maximise stability	10	12	7	16	3	16	3	9.6	13
15 Maximise employment on viable fishing units	16	10	-	-	6	16	6	10.7	10
16 Maximise catch in tonnes	11	20	-	-	1	20	1	10.7	19
17 Maximise Social Yield	14	-	14	-	9	14	9	12.3	5
18 Maximise consumer welfare/happiness	5	18	4	18	17	18	4	12.4	14
19 Maximise fisher welfare/happiness	4	17	10	14	18	18	4	12.6	14
20 Maximise number of fishing units	15	19	-	5*	13	19	5	13.0	14
21 Maximise fishing community viability	18	10	16	15	-	18	10	14.8	8
22 Maximise resilience	13	14	17	17	15	17	13	15.2	4
23 Maximise GVA over the entire value chain	17	16	11	18	14	18	11	15.2	7
24 Maximise community biomass	19	15	-	-	16	19	15	16.7	4

MSY Variants Categorised

System characteristic	System value	Three important MSY Variants
Stock	Separate niche stock caught in single species fisheries	**16** Maximise catch in tonnes **14** Maximise stability **13** Maximise willingness to invest in the future fisheries
	Mixed stock – Separate niches	**2** Maximise yield in value of key commercial species **8** Maximise Resource Rent **13** Maximise willingness to invest in the future fisheries
	Mixed stock – Common niches	**2** Maximise yield in value of key commercial species **14** Maximise stability **12** Maximise useful knowledge
Fleet	Simple fleet – Artisanal	**15** Maximise employment on viable fishing units **14** Maximise stability **17** Maximise Social Yield
	Simple fleet – Industrial	**16** Maximise catch in tonnes **5** Maximise Net Present Value **15** Maximise employment on viable fishing units
	Mixed fleet – Artisanal and Industrial	**2** Maximise yield in value of key commercial species **14** Maximise stability **1** Maximise inclusive governance
Area	Distant	**16** Maximise catch in tonnes **14** Maximise stability **4** Maximise yield in value
	Close	**2** Maximise yield in value of key commercial species **22** Maximise resilience **1** Maximise inclusive governance (multiple activities)
Data availability	Data rich	**2** Maximise yield in value of key commercial species **14** Maximise stability **13** Maximise willingness to invest in the future fisheries
	Data poor	**16** Maximise catch in tonnes **1** Maximise inclusive governance **X** Maximise any other data-available indicators

Deliverable D4.1 **Ist Synthesis Workshop**
John Mumford et al.

MSY Variants Modelled

Output or input category	MSY Variant	Model commentary
Physical measures of output	16 Catch	Can be deterministic, short-term, covers total biomass of range of catch species
	14 Stability	Must be stochastic, could be short or long-term; may relate to one or more species of interest
	22 Resilience	Must be stochastic, multi-year, variable inputs; may relate to one or more species
Economic measures of output	4 Current value	Can be deterministic, short term, value of all species in catch
	2 Value of key commercial species	Can be deterministic, short term, focused on key species
	8 Resource rent	Can be deterministic, short term, value of all species in catch
	5 Net Present Value	Multi-year, can be stochastic, value of all species in catch
Socio-economic measures of output	17 Social yield	Focus on highlighting trade-offs in social values produced
	13 Willingness to invest	Single social measure integrates present and future values, multi-year horizon
	15 Employment	Effort and value functions need to relate to the level of employment
Physical measures of input	12 Useful knowledge	Model based on use of all relevant information, likely to be complex
Social measures of input	1 Inclusive governance	Simple listing of participants, but could also include reference to weighting of the degree of inclusion
Data-poor cases	*X Output related to any available measures*	*More likely to involve qualitative relationships and conceptual models*

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Modelling approaches

- Maximization under constraints SMS/EEE
- MEFISTO (black box) model
- SMS for biological interactions
- Fishrent for technical interactions
- Fishrent with Ecopath with Ecosim (in combination)
- Two type of fleet dynamics were modelled, with and without profit incentive
- Multispecies modelling
- Tuna and other Pelagic stocks (sandeel, herring, sprat)
- MSE based on single stock assessment model

Context for stakeholders

- Baltic: Collapse of stock assessment
- Eastern Med: Greek financial crisis
- NS and Western Waters: New SFP, specifically 'landing obligations'
- Widely Ranging:
  - Mackerel catch opportunities between countries
  - Lack of acceptance of 'there is no scientifically determined MSY'

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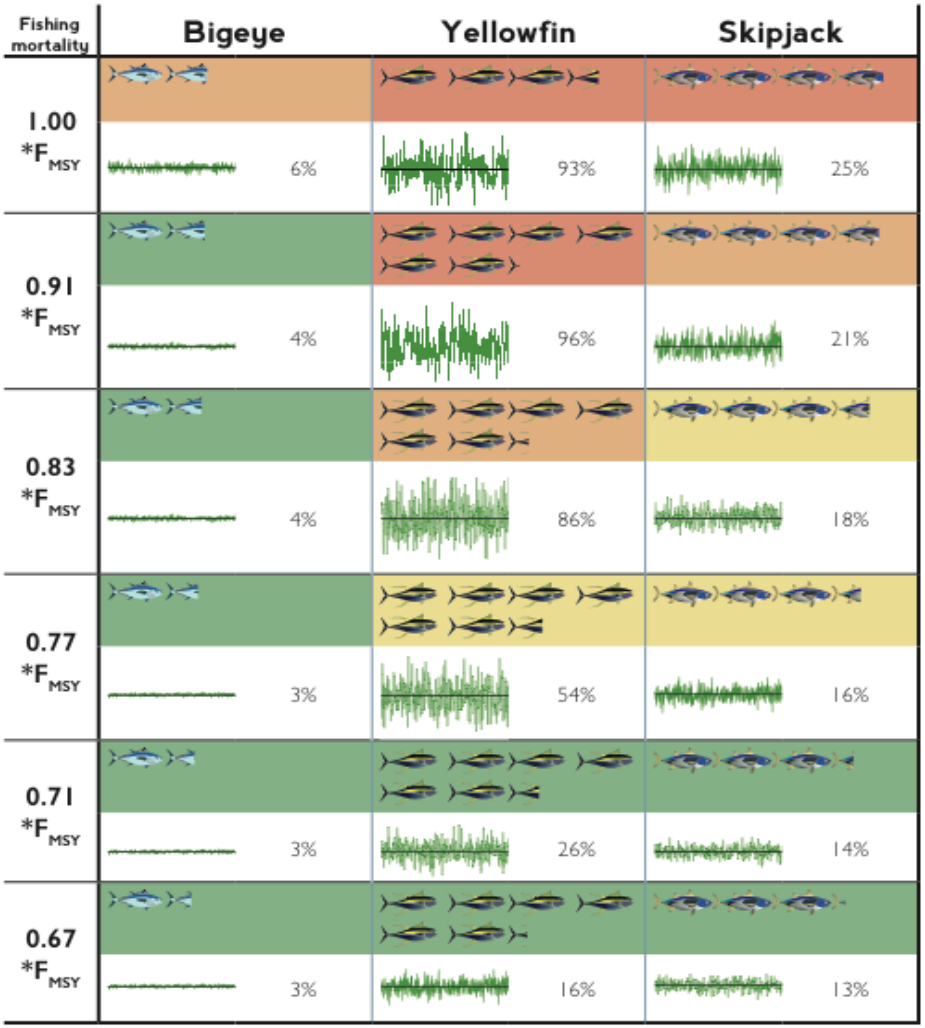
Widely Ranging:
Indian Ocean Tuna

DST Icon Array output example

Single-species management DST



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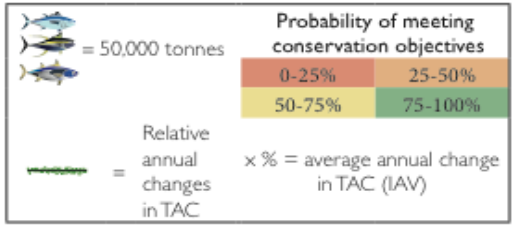

Deliverable 3.1 **Report on Stakeholder Priorities for MSY and Acceptable Management Variants**
John Mumford et al.

Operational framework

Problem framing — Objectives not currently met

- Identify **objectives, priorities and acceptance criteria** for all stakeholders in relation to MSY
- Identify possible **trade-offs**
- Identify governance and institutional settings

Options — Agreed dimensions for decisions

Implementation — Trade-offs addressed

Evaluation — Outcomes that meet wider aims

Deliverable 1.3 **Final operational framework for the attainment of MSY while respecting constraints** Dave Reid et al.

Operational framework

Problem framing — Objectives not currently met

Options — Agreed dimensions for decisions

- Identify state of **current knowledge, quantitative or conceptual models, data and uncertainty**
- Consider **definitions of MSY Variants** in relation to legal constraints for MSY
- Focus stakeholders on MSY Variants **relevant to their common circumstances**
- Determine **how and which models** to be implemented for alternative MSY Variants
- **Treat risk and uncertainty explicitly**, in data collection, models, governance
- Present the set of management **options to fisheries managers**

Implementation — Trade-offs addressed

Evaluation — Outcomes that meet wider aims

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Operational framework

Problem framing — Objectives not currently met

Options — Agreed dimensions for decisions

Implementation — Trade-offs addressed

- Explore **stakeholder responses** to options in modelled outputs; visual techniques to demonstrate trade-offs
- Relate model **outcomes to stakeholder objectives**
- Present the set of relevant implementation **measures to fisheries managers**

Evaluation — Outcomes that meet wider aims

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Operational framework

Problem framing — Objectives not currently met

Options — Agreed dimensions for decisions

Implementation — Trade-offs addressed

Evaluation — Outcomes that meet wider aims

- Demonstrate how **revised management differs** from that for MSY
- **Review options and implementation** as circumstances change or if the process fails to meet objectives
- Anticipate and **plan for changes** in practices with new management
- Identify **gaps for the future**, including legal conflicts

Deliverable 1.3 **Final operational framework for the attainment of MSY while respecting constraints** Dave Reid et al.

North Sea framework

Actual practice in a Regional Workshop

Problem framing — Objectives not being met

- Identify **objectives, priorities and acceptance criteria** for all stakeholders in relation to MSY
- Identify possible **trade-offs**
- Identify governance and institutional context

Reflection (Options) workshops — Set dimensions

- Identify state of **current knowledge, quantitative or conceptual models, data and uncertainty**
- Relate model **outcomes to stakeholder objectives**
- Determine **how and which models** would be implemented for alternative MSY Variants

Scenarios (Implementation) — Modelling

- **Treat risk and uncertainty explicitly**, in data collection, models and governance processes
- Demonstrate how the **revised management differs** from that for MSY

Evaluation — Relate outcomes to wider aims

- Present the set of management **options to fisheries managers**
- Present the set of relevant implementation **measures to fisheries managers**
- Explore **stakeholder responses** to modelled options; visual techniques demonstrate trade-offs
- **Review options and implementation** as circumstances change or if the process fails to meet objectives

Conclusions

- Sequential inclusive workshop approach was demonstrated
  - Relevant models and visualisation techniques used across seven fisheries to test attitudes to MSY variants
  - DSTs were viewed positively, in general, as starting point for discussion
- Stakeholders expressed views that models did not always address the most pertinent problems, such as:
  - Short term transitions
  - Specific regulations
  - Subsidies and Social costs
  - GES
  - Risk
- Stakeholders liked flexibility, such as ranges of objectives, rather than points, 'pretty good yield', or qualitative criteria

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Thank you for your attention!

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