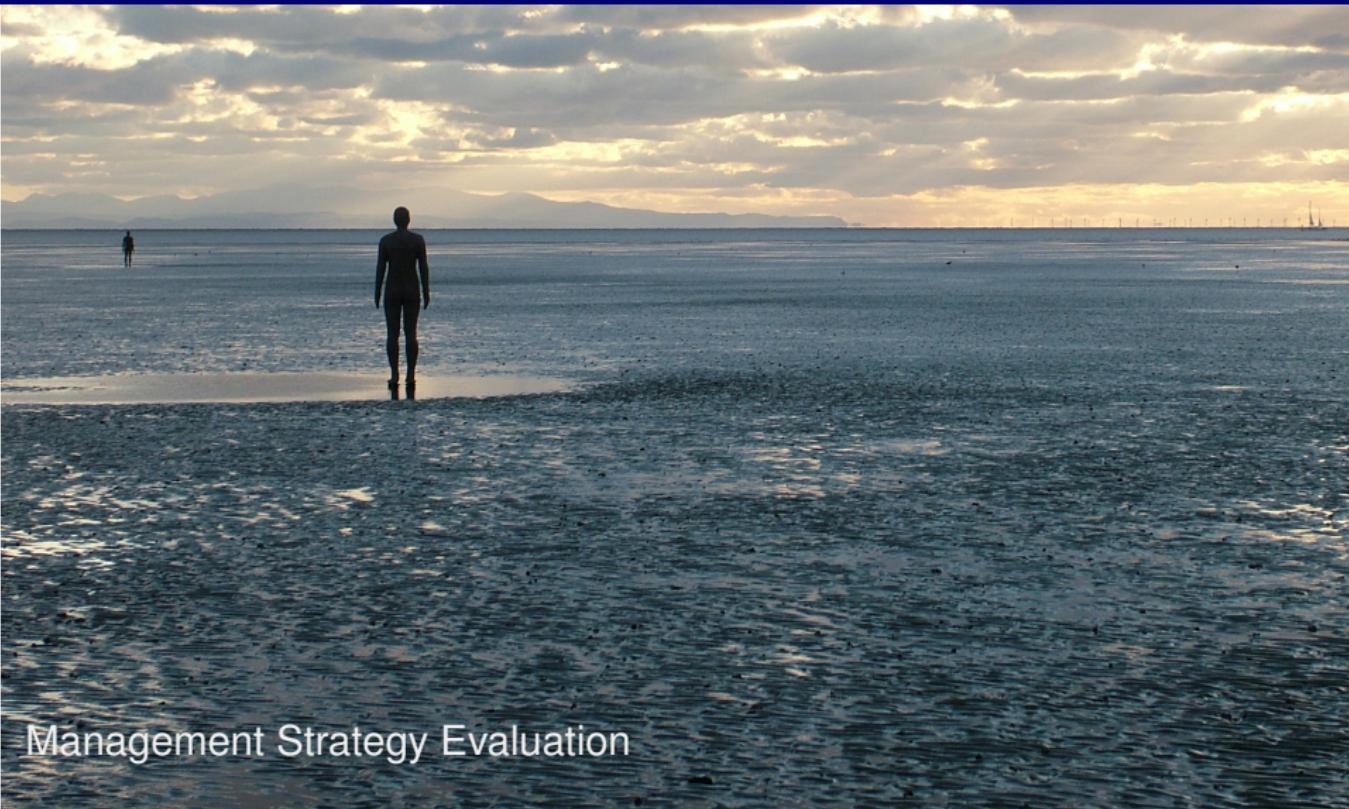


North Atlantic Albacore Management Strategy Evaluation IOTC Methods

Laurence Kell ICCAT

October 23, 2013



Management Strategy Evaluation

North Atlantic Albacore

1 Objectives

2 Work So Far

3 Work To Do

4 Linkages

- ICCAT
- Methods
- tRFMOs

Management Framework

- **Objective** of ICCAT is to maintain populations at levels which will permit the maximum sustainable catch.
Originally interpreted as MSY being a target.
- The **Precautionary Approach** requires stocks to be assessed relative to limits and targets, to predict management outcomes relative to reaching targets and avoiding limits given uncertainty. So F_{MSY} is now a limit.
- The Commission has asked the SCRS to develop a **Biomass Limit Reference Point** that will trigger a rebuilding plan if biomass drops below it. I.e.

North Atlantic Albacore

Biomass Limit Reference Point

- In advance of the next assessment of Northern Atlantic Albacore (i.e. June 2013), the SCRS shall develop a Limit Reference Point (LRP).
- Future management decisions shall include a measure that would trigger a rebuilding plan, should the biomass decrease to a level approaching the defined LRP as established by the SCRS. [REC 11-04].

Harvest Control Rules

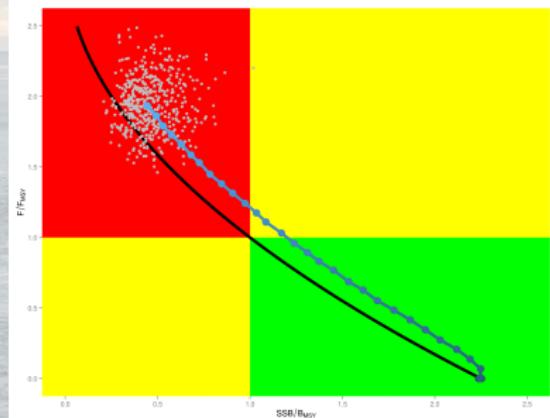
The Precautionary Approach

- Imposes specific needs for research, stock assessments, monitoring and management.
- A **HCR** is recommended to specify in advance what actions should be taken when limits are reached.
- Although HCRs may include precautionary elements, it does not follow that they will be precautionary in practice, if they are not formally evaluated to determine whether they will actually achieve the goals for which they were designed, given uncertainty.
- Hence the use of **Management Strategy Evaluation**

ICCAT: Principles of Decision Making

Red Quadrant

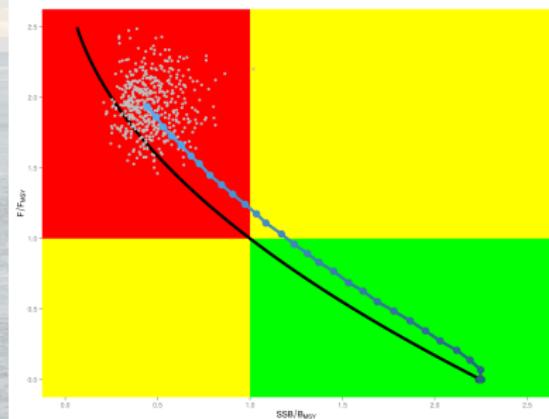
- Management should ensure a high probability of ending overfishing in as short a period as possible. A plan must be adopted for rebuilding taking into account the biology of the stock and SCRS advice.
- Risk, Probabilities and Time Scales not specified.**



ICCAT: Principles of Decision Making

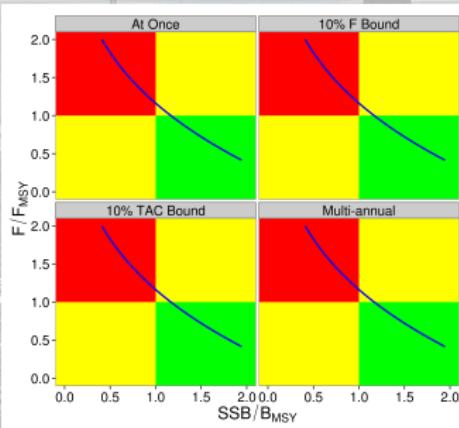
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Social & Economic Decision

Long v. Short-term Year 1

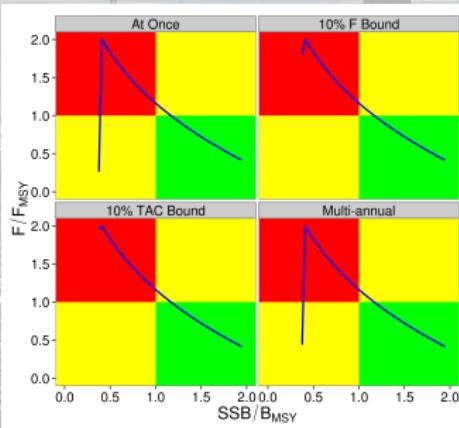


4 ways of reducing Effort

- All at Once
- By 10% a year
- With a constraint on TAC, so it can only change by 10% a year
- In 3 Year blocks

Social & Economic Decision

Long v. Short-term Year 2

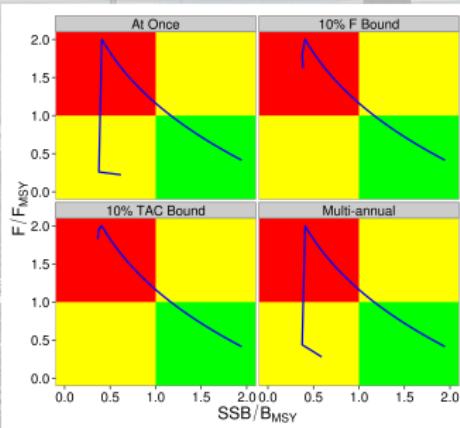


4 ways of reducing Effort

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- With a constraint on TAC, so it can only change by 10% a year
- In 3 Year blocks

Social & Economic Decision

Long v. Short-term Year 3

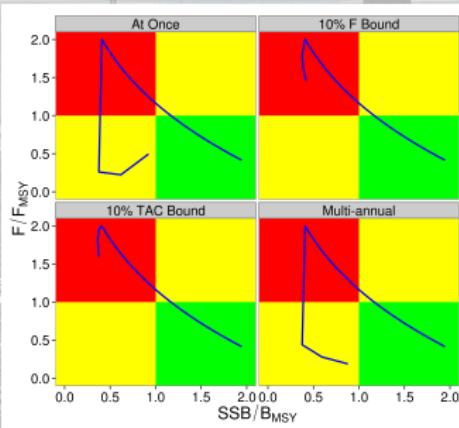


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- In 3 Year blocks

Social & Economic Decision

Long v. Short-term Year 4

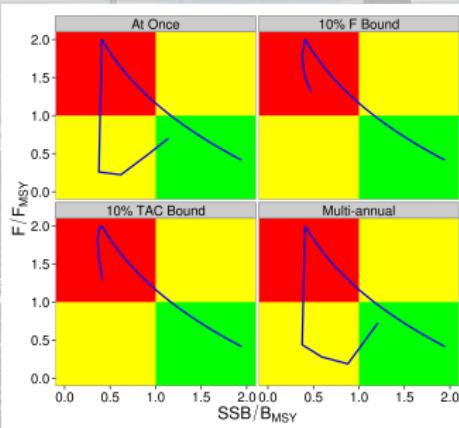


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Social & Economic Decision

Long v. Short-term Year 5

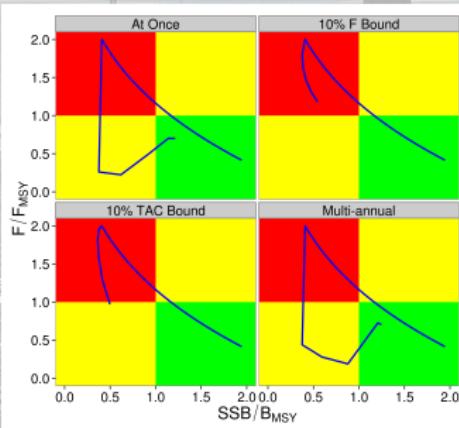


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- In 3 Year blocks

Social & Economic Decision

Long v. Short-term Year 6

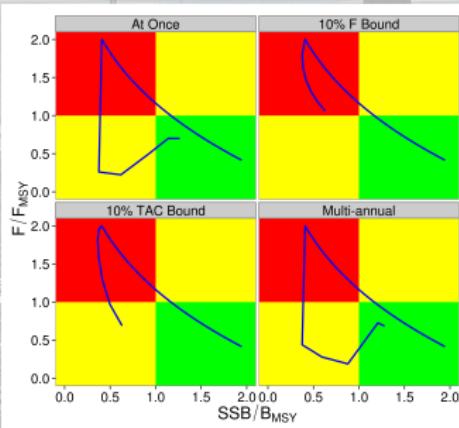


4 ways of reducing Effort

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Social & Economic Decision

Long v. Short-term Year 7



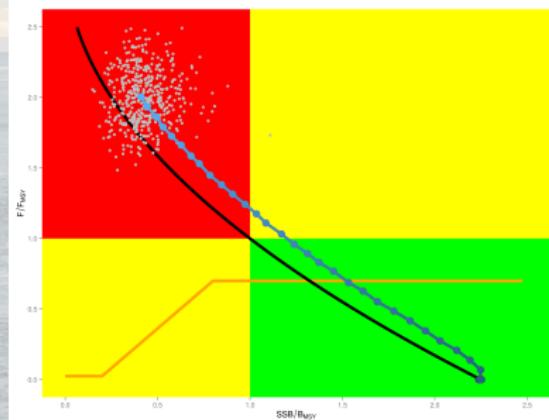
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ICCAT: Principles of Decision Making

Red Quadrant

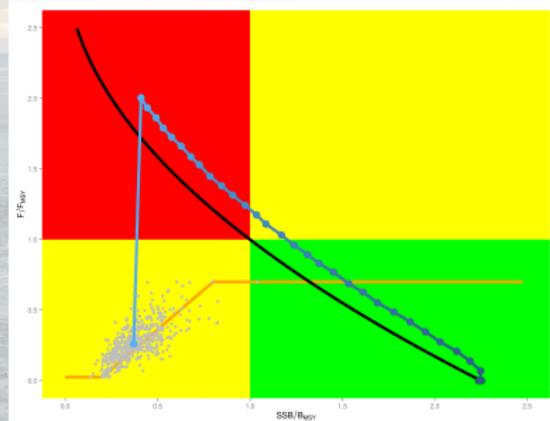
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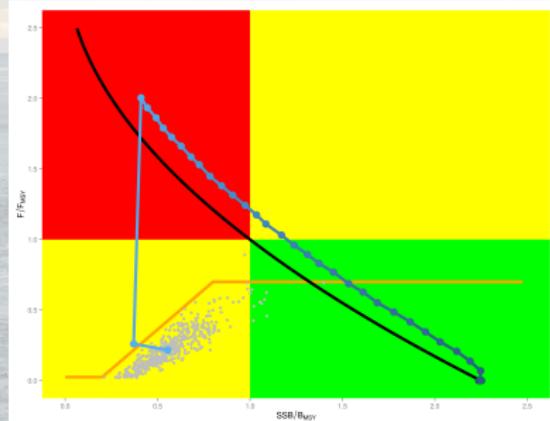
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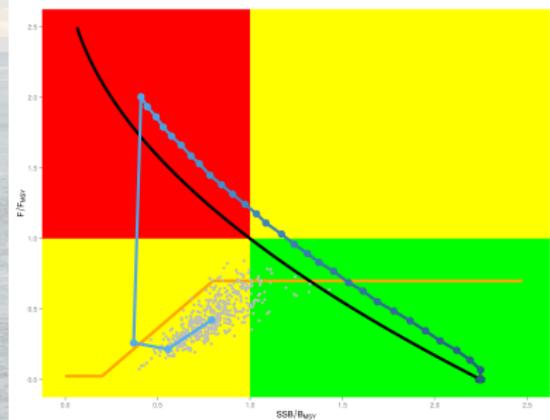
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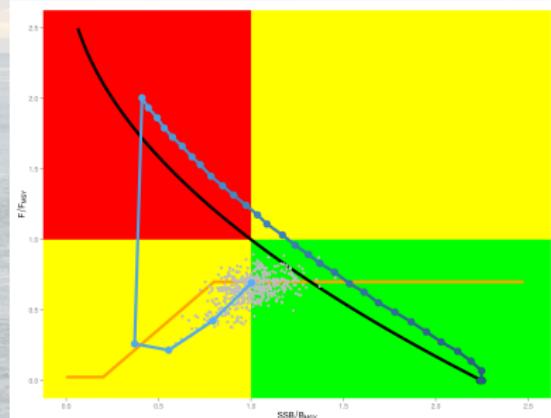
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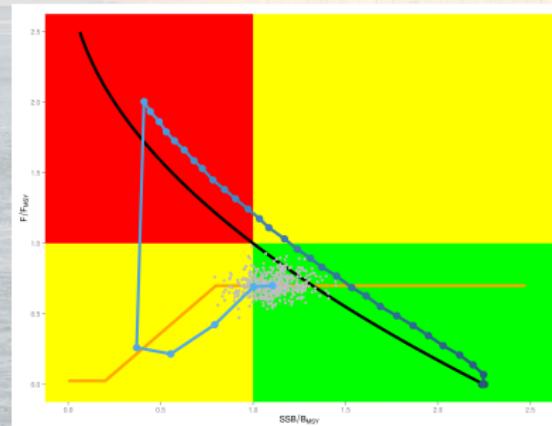
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ICCAT: Principles of Decision Making

Green Quadrant

For stocks that are not overfished and not subject to overfishing management measures shall be designed to result in a high probability of maintaining the stock within the green quadrant.



Harvest Control Rules

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- Hence the use of **Management Strategy Evaluation**

Management Strategy Evaluation

MSE involves a number of steps i.e.

Objectives and performance measures to quantify whether goals have been achieved.

Operating Models i.e. simulation models based on hypotheses

Conditioning the OM's based on data and knowledge and rejection and weighting of hypotheses

Management Strategies need to be identified and coded as Management Procedures

Conditioning the OM's, based on data and knowledge and rejection and weighting of hypotheses

Running the MSE to evaluate the Management Strategies

Adopting the Management Strategy that best meets Management Objectives

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ICCAT Scientific Committee Papers

Methods WG

SCRS2013-34 Operating Model Based on Multifan-CL

SCRS2013-33 Management Procedure Based on a Biomass Dynamic Model

SCRS2013-35 Management Strategy Evaluation of a LRP as part of a HCR

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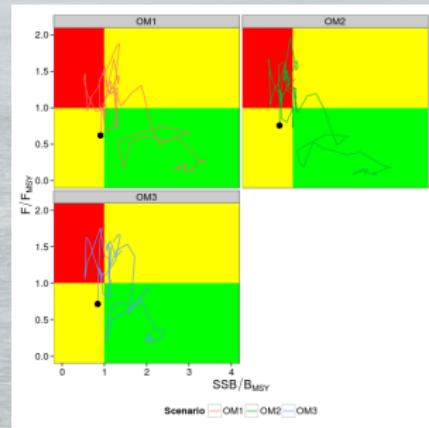
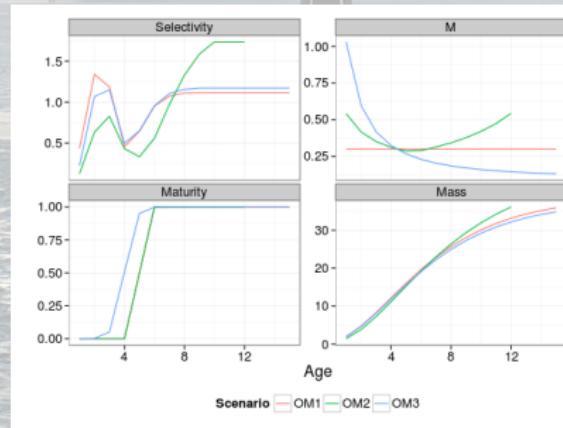
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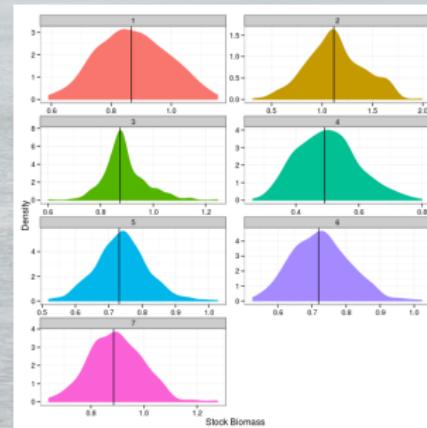
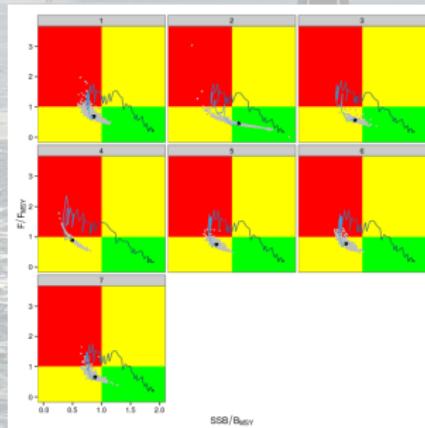
Management Strategy Evaluation in 2013

Operating Model based on Multifan-CL



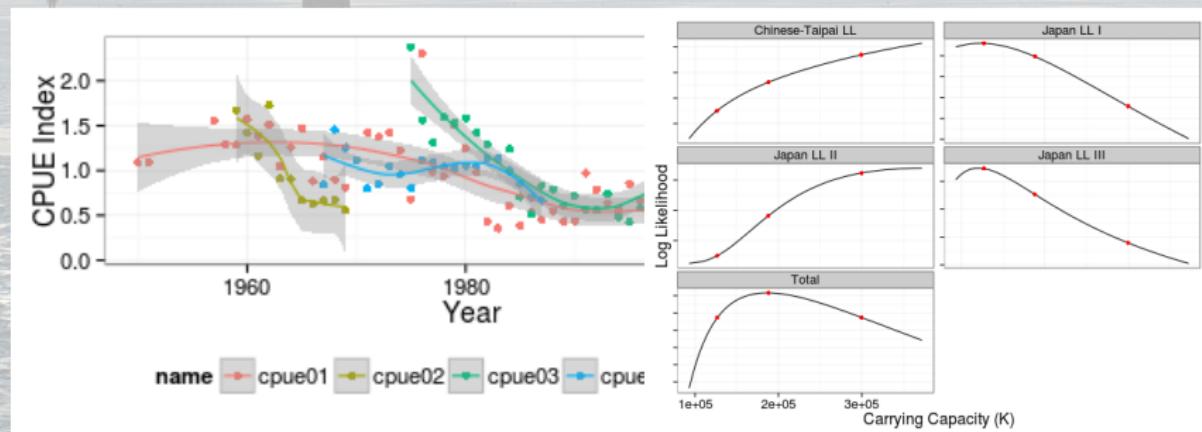
Management Strategy Evaluation in 2013

Management Procedure based on Biomass Dynamic Model



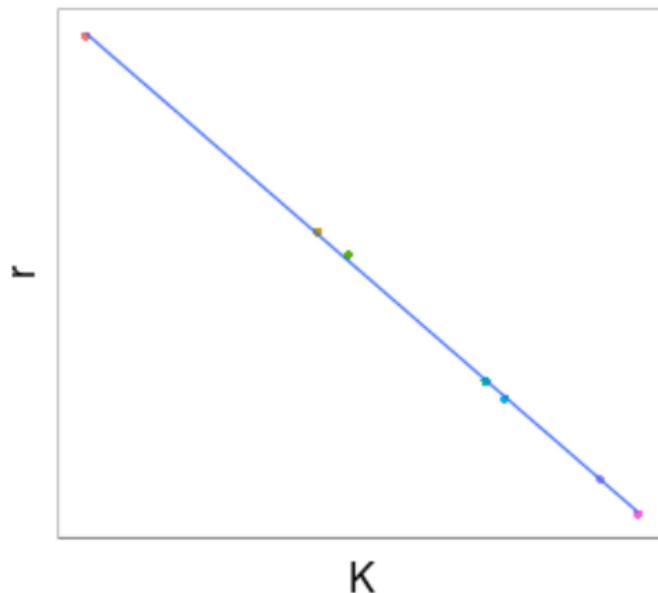
Management Strategy Evaluation in 2013

CPUE series



Management Strategy Evaluation in 2013

r v K from ASPIC Assessment



Scenario

- Japanese old and new LL
- China Taipei one series
- China Taipei old and new LL only
- All
- Without China Taipei
- Without Japanese
- Composite surface cpue only

Management Strategy Evaluation in 2013

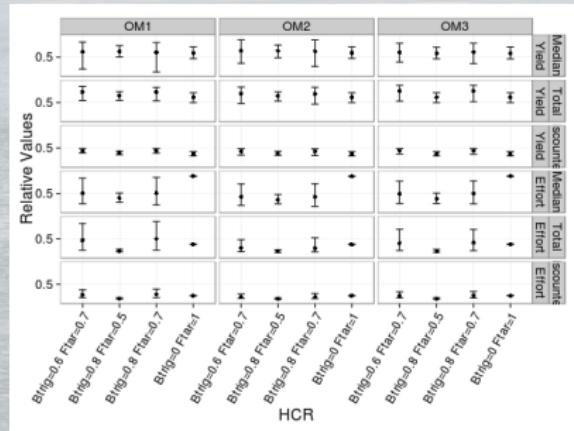
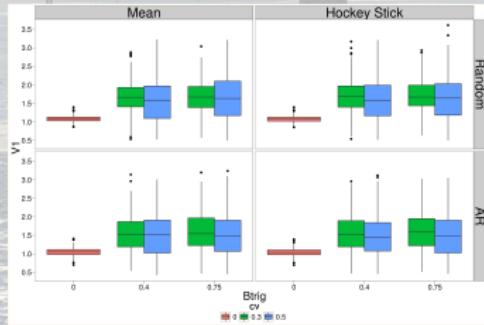
Kobe II Strategy Matrices

Kobe II Strategy matrix. Future probability of $SSB > SSB_{MSY}$ and $F < F_{MSY}$ for different combinations of $B_{threshold}$ and F_{target} values

$B_{threshold}$	F_{target}	2013		2020		2030		Average catch:	Cumulative catch:																
		3 years	5 years	10 years	15 years	20 years	139		294	455	620														
0.6 B_{MSY}	0.75 F_{MSY}	29	32	36	49	54	57	61	65	68	70	73	75	77	78	80	81	82	84	27	139	294	455	620	
0.6 B_{MSY}	0.80 F_{MSY}	29	31	35	45	52	55	58	61	64	67	69	71	74	75	77	78	79	80	28	146	306	472	643	
0.6 B_{MSY}	0.85 F_{MSY}	29	31	33	42	47	52	55	57	59	62	64	67	69	71	72	74	76	77	30	153	318	489	663	
0.6 B_{MSY}	0.90 F_{MSY}	29	30	30	39	42	46	50	52	54	56	58	60	62	64	66	68	70	71	31	160	330	504	681	
0.6 B_{MSY}	0.95 F_{MSY}	29	29	20	36	37	39	42	40	44	48	50	51	52	54	55	56	58	60	61	33	166	340	517	697
0.8 B_{MSY}	0.75 F_{MSY}	29	32	42	51	55	59	63	67	70	72	75	76	78	80	81	83	86	88	25	134	289	452	619	
0.8 B_{MSY}	0.80 F_{MSY}	29	32	41	50	53	56	59	62	66	69	71	73	75	77	78	80	81	83	27	140	302	470	641	
0.8 B_{MSY}	0.85 F_{MSY}	29	31	39	48	50	53	56	58	61	63	67	69	71	73	75	76	77	79	28	147	314	486	662	
0.8 B_{MSY}	0.90 F_{MSY}	29	30	35	46	48	50	51	54	56	58	60	62	64	67	69	70	72	73	29	154	325	501	680	
0.8 B_{MSY}	0.95 F_{MSY}	29	29	23	45	45	46	47	48	49	51	52	54	55	56	58	59	61	63	31	160	335	515	696	
0.9 B_{MSY}	0.75 F_{MSY}	29	35	47	58	62	68	72	75	78	80	82	84	87	90	92	94	95	96	23	123	278	442	611	
0.9 B_{MSY}	0.80 F_{MSY}	29	34	46	56	61	66	71	73	76	78	80	82	85	87	90	92	94	95	24	129	290	459	633	
0.9 B_{MSY}	0.85 F_{MSY}	29	33	45	55	59	63	69	71	74	77	78	80	82	84	87	89	91	93	25	136	301	475	653	
0.9 B_{MSY}	0.90 F_{MSY}	29	33	42	54	56	60	66	68	71	74	76	77	79	81	83	85	87	89	26	141	312	489	671	
0.9 B_{MSY}	0.95 F_{MSY}	29	32	32	52	54	57	62	64	67	70	72	73	76	77	78	79	80	81	83	27	147	322	502	687

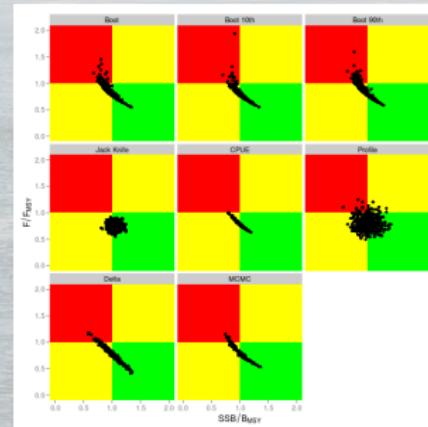
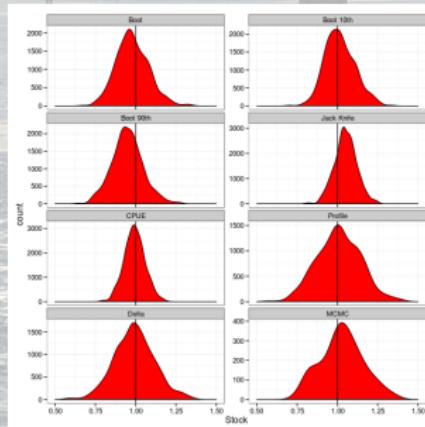
Management Strategy Evaluation in 2013

Evaluation of a Harvest Control Rule



Management Strategy Evaluation in 2013

Different Approaches for Modelling Uncertainty



Management Strategy Evaluation in 2014

Steps

Objectives and performance measures to quantify whether goals have been achieved.

Scenarios based on hypotheses needed for developing OMs.

Management Strategies identification of alternatives and coding up as Management Procedures.

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Management Strategy Evaluation in 2014

2014 SCRS Papers planed to document MSE

MSE Framework

OM Conditioning

Observation Error Model to simulate Data Collection and Monitoring

Evaluation and selection of MP using performance measures

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Management Strategy Evaluation in 2014

Experimental Design

- Scenarios will be based on a base case (**BC**) and a factorial design with several **factors** each with discrete **levels**.
- A large number of scenarios will need to be considered for the **OM**, **OEM** and **MP** to evaluate the main sources of uncertainties.
- Due to the potentially large number of combinations a fractional factorial design in which only some of the possible combinations are run may be preferred.
- Choice and weighting of scenarios depends on plausibility.

Management Strategy Evaluation in 2014

Operating Model

Factor	Levels	ΣN	Values	Prior	Weighting
M_0	3	3	0.3; Lorezen; Chen & Watanabe	?	?
Maturity	2	6	(0,0,0,0,.5,1,...); (0,0,0,0.25,.5,.75,1,...)	?	?
CPUE	2	12	BC; ...	?	?
LL Selectivities	2	24	BC, ...	?	?
Penalty on recruit devs	2	48	BC; ...	?	?
CAS	3	144	BC; include Tai sz; drop all sz	?	?
Sample size	2	288	BC; ...	?	?
Sample size	2	576	BC; tagging data	?	?

Management Strategy Evaluation in 2014

Management Procedure

Factor	Levels	ΣN	Values	Prior	Weighting
r	3	3	estimate; prior, perfect	?	?
K	3	9	estimate; prior, perfect	?	?
Shape	3	27	fix; prior, perfect	?	?
B_{target} as % of F_{MSY}	3	81	60%,75%,90%	?	?
B_{lim} as % of B_{MSY}	3	243	30%,35%,45%	?	?
B_{lim} as % of K	3	729	15%,20%,25%	?	?
$B_{Threshold}$ as % of B_{MSY}	3	2187	70%,85%,100%	?	?
$B_{Threshold}$ as % of K	3	6561	35%,40%,50%	?	?

Management Strategy Evaluation in 2014

Observation Error Model

Factor	Levels	ΣN	Values	Prior	Weighting
Catch σ	3 0.2,0.3,0.4	3		?	?
CPUE σ	3 0.2,0.3,0.4	9		?	?
CPUE ω	2 0.5, 1, 2	18		?	?
CPUE age range	3 all, adults	54		?	?

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R, C++, Adol-C and ADMB

FLR Main framework that allows plug and play

FLash based on R & Adol-C for fast numerical routines

biodyn Dynamic Model using ADMB

FLBRP Biological Reference Points, same as used by ICES to develop PA

R4MFCL Reading Multifan-CL results into R when conducting the OM

kobe Summarise results and Performance Measures in Kobe Framework

doparallel All R code can be run in parallel on a laptop or the Cloud

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FLR Main framework that allows plug and play

FLash based on R & ADol-C for fast numerical routines

biodyn Biomass Dynamic Model using ADMB

FLBRP Biological Reference Points, same as used by ICES to develop PA

R4MFCL Reading Multifan-CL results into R when conditioning the OM

kobe Summarise results and Performance Measures in Kobe Framework

doparallel All R code can be run in parallel on a laptop or the Cloud

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Tuna RFMOs



tuna-org <http://www.tuna-org.org/>

tRFMO-MSE <http://ssloroed.iccat.int/timo-mse>

Tuna RFMOs



tuna-org <http://www.tuna-org.org/>

tRFMO-MSE <http://rscloud.iccat.int/trfmo-mse>