# Panel 2: Sapporo

Advances in MSE within ICCAT

ICCAT MSE

- How did we get here?
- Is anything going to change?
- How is it done and who does what?
- SCRS progress:
  - Albacore North
  - Bluefin tuna
- What next

SCRS → Commission WGSAM → #2 WG Dialog

2014 WG Future of ICCAT ← 2015 2011 Resolution

#1 WG Dialog ← WGSAM Commission ← SCRS

2013 Rec 2015-04 Rec 2015-07 WGSAM → ALB SA

How did we get here?

Initital proposal for ALBN HCR and target reference points

2016

Panel 2 Sapporo

?? Commission ← SCRS

3

Is anything going to change?
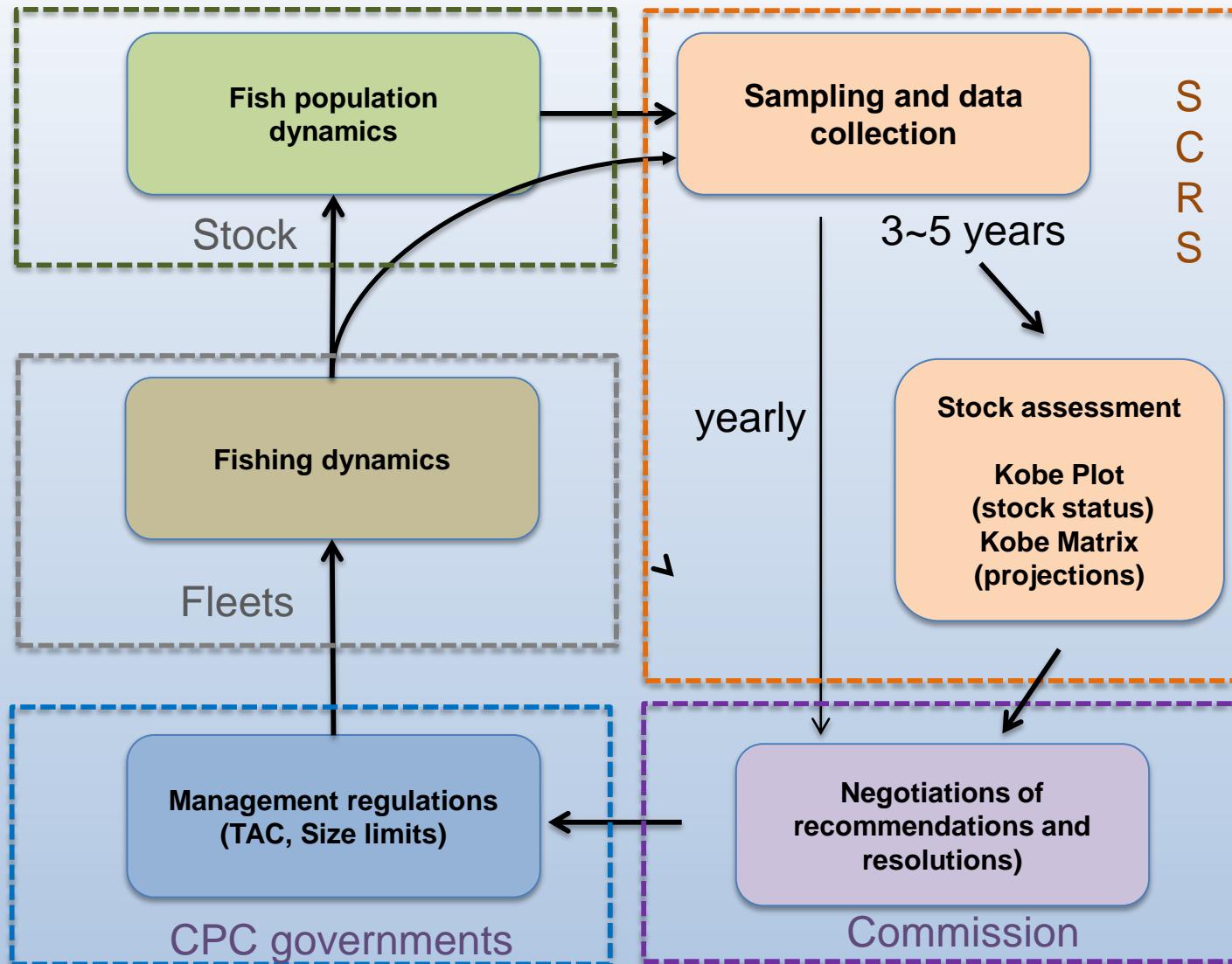
Compare:

Current process of assessment and provision of management advice
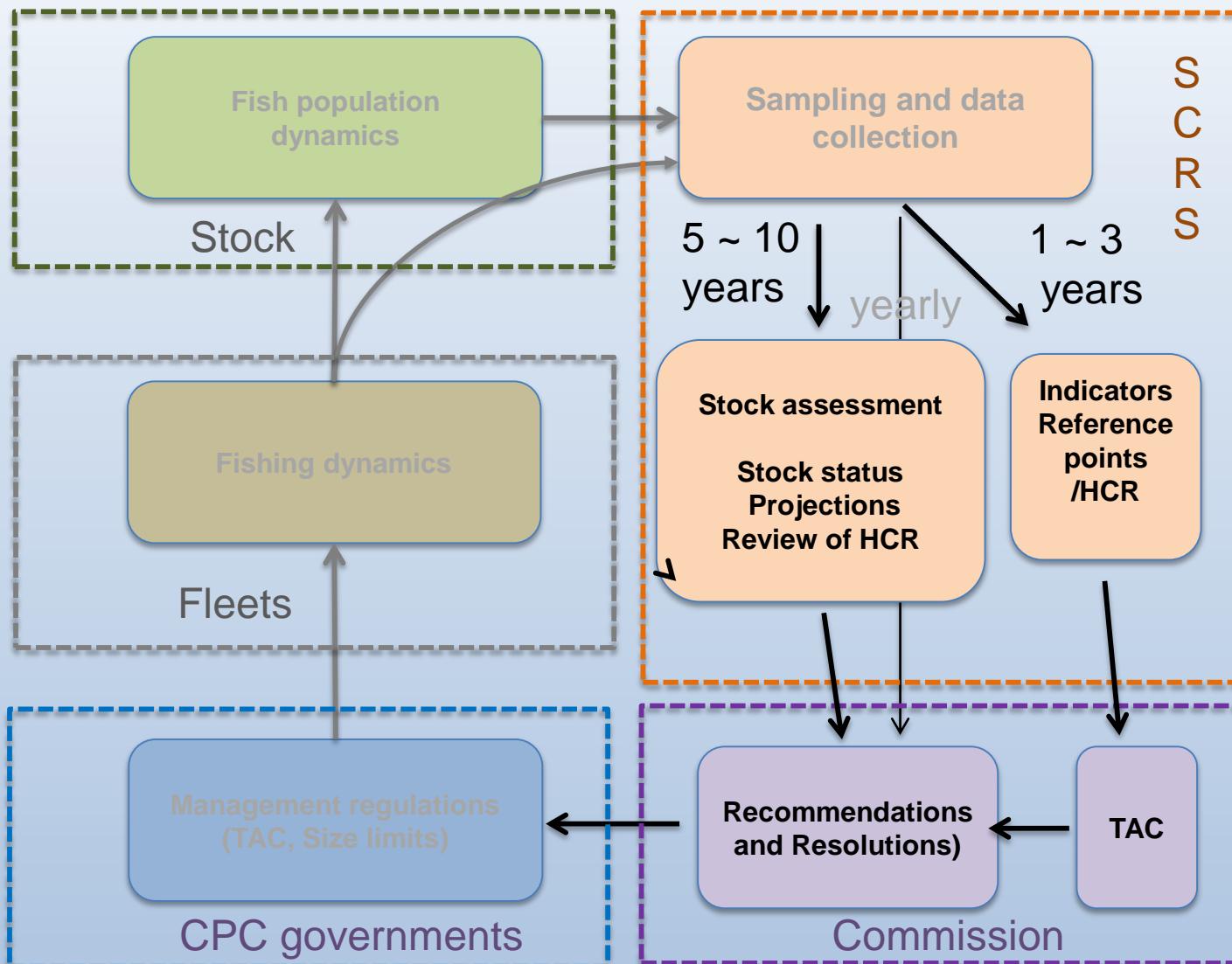
Management process when MS is adopted
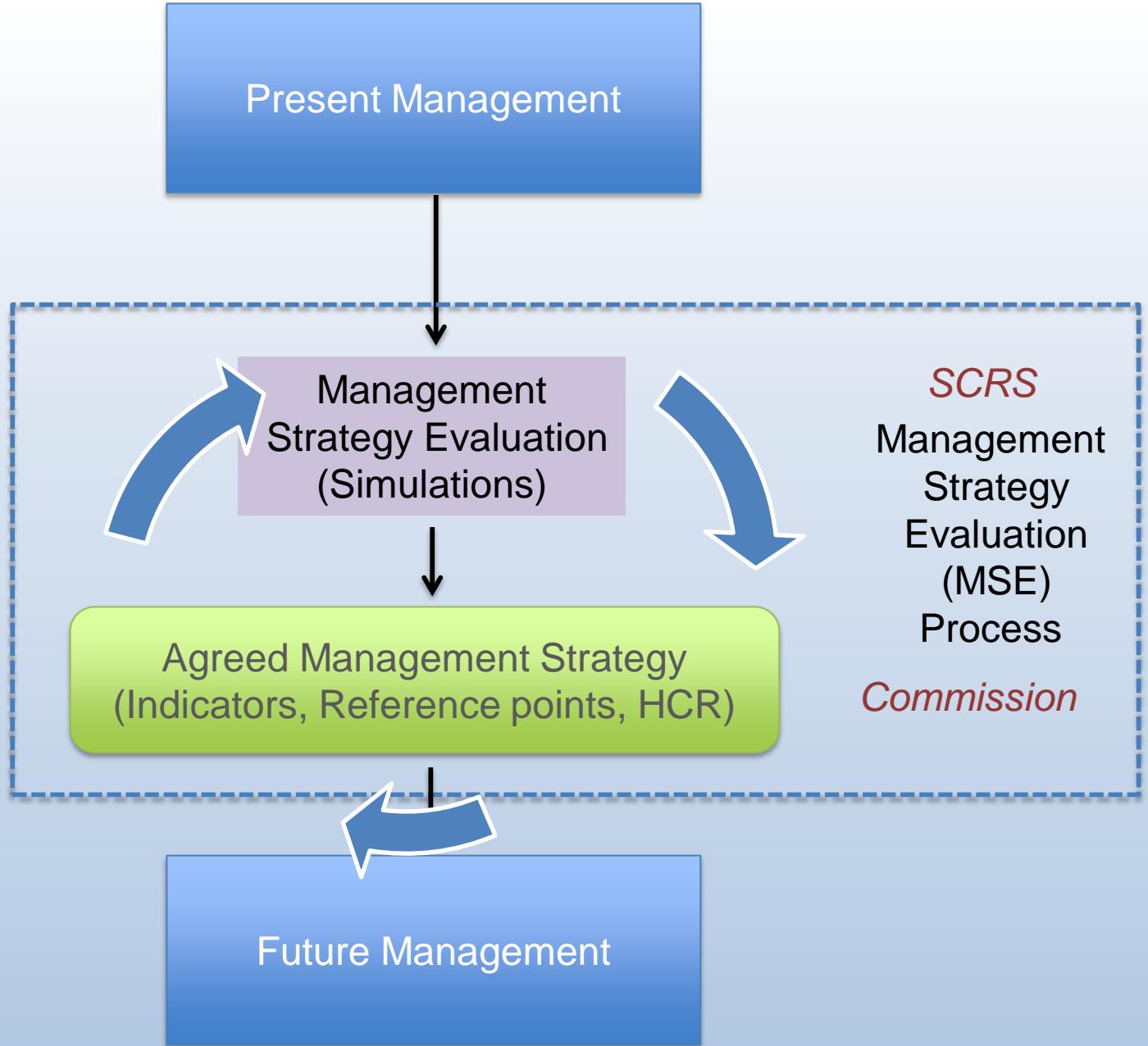
Current ICCAT Management

Fish population dynamics

Stock

Sampling and data collection

S C R S

3~5 years

Fishing dynamics

Fleets

yearly

Stock assessment

Kobe Plot (stock status)
Kobe Matrix (projections)

Management regulations (TAC, Size limits)

CPC governments

Negotiations of recommendations and resolutions)

Commission

Future ICCAT Management
Rec 2015-04, 2015-07

Present Management

Management Strategy Evaluation (Simulations)

SCRS

Management Strategy Evaluation (MSE) Process

Agreed Management Strategy (Indicators, Reference points, HCR)

Commission

Future Management

How is MSE done and who does what?

	Commission	SCRS
MSE steps:		
• Identify management objectives and map these to indicators of performance;	X	x
• Select hypotheses for Operating Model (OM), condition the OM based on data and knowledge,	x	X
• Develop observation model	x	X
• Identify candidate MS, limit and target reference points and harvest control rules (HCRs)	X	X
• Project the OM forward in time using the MS and calculate performance indicators		X
• Identify the MS/MP that robustly meet management objectives.	X	

Objective of MSE simulations

- Test performance of alternative Management Strategies (MS) :

  (MS also called Management Procedures MP)

  MS

  - Data used (how collected)
  - Indicators of stock status (how estimated)
  - Harvest Control rule

- Report performance of alternative MS to Commission
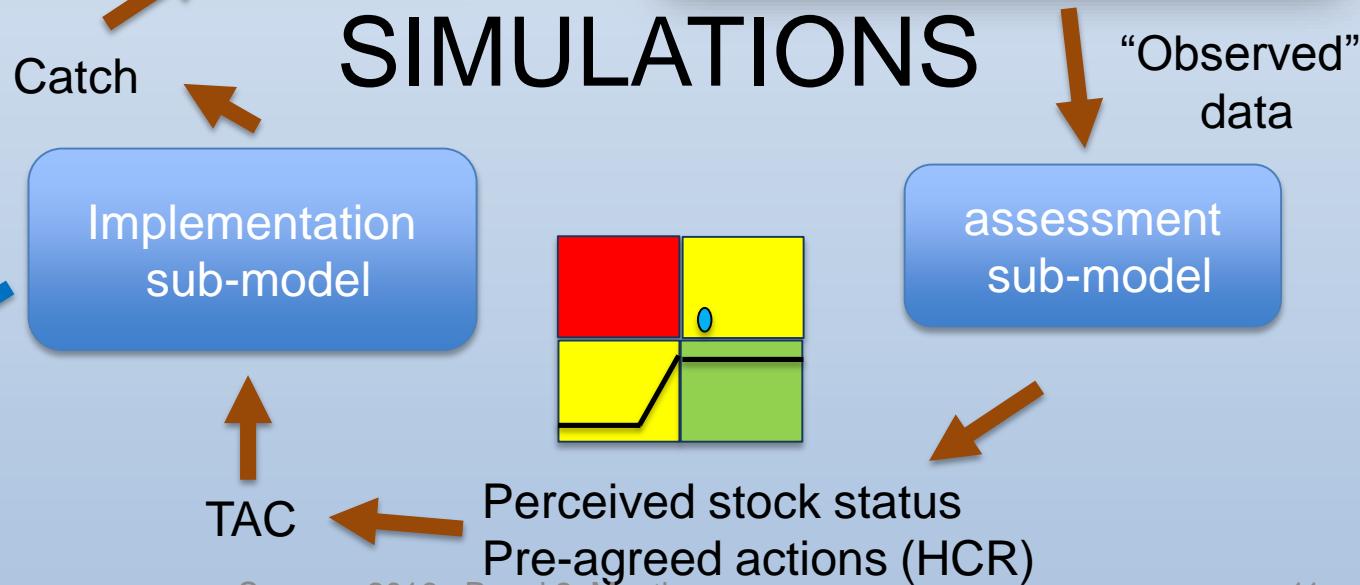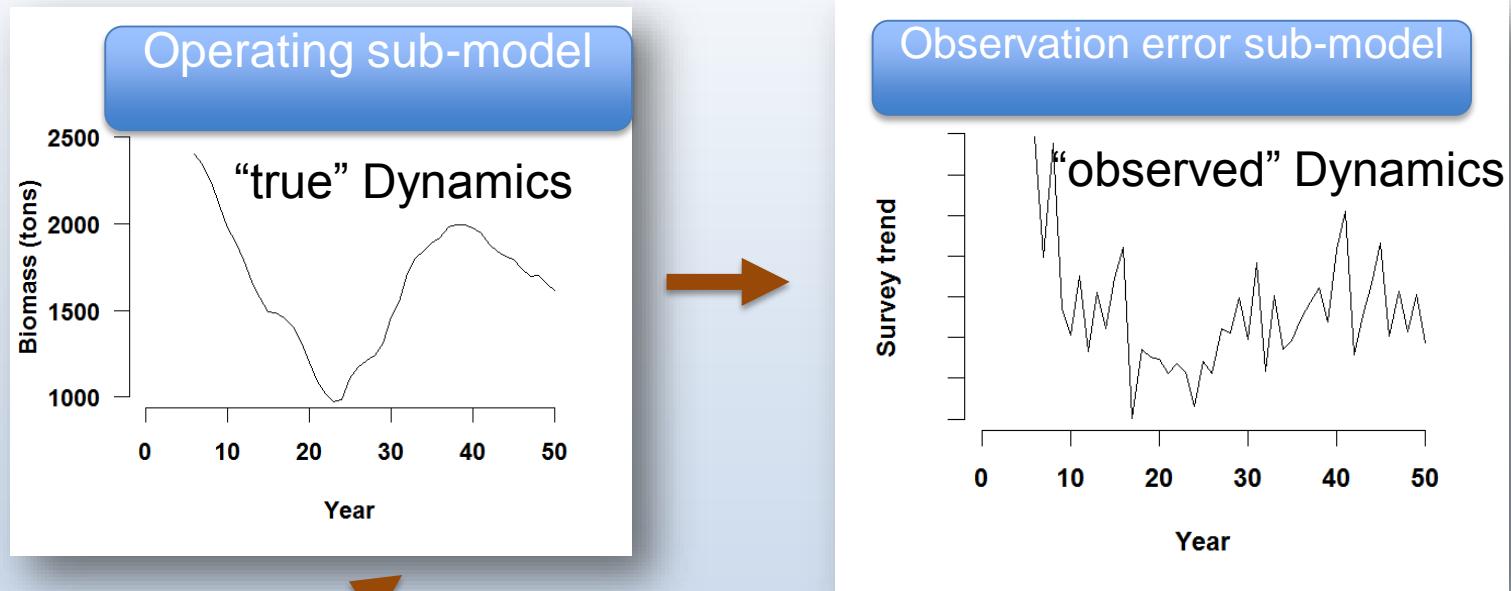
MS components
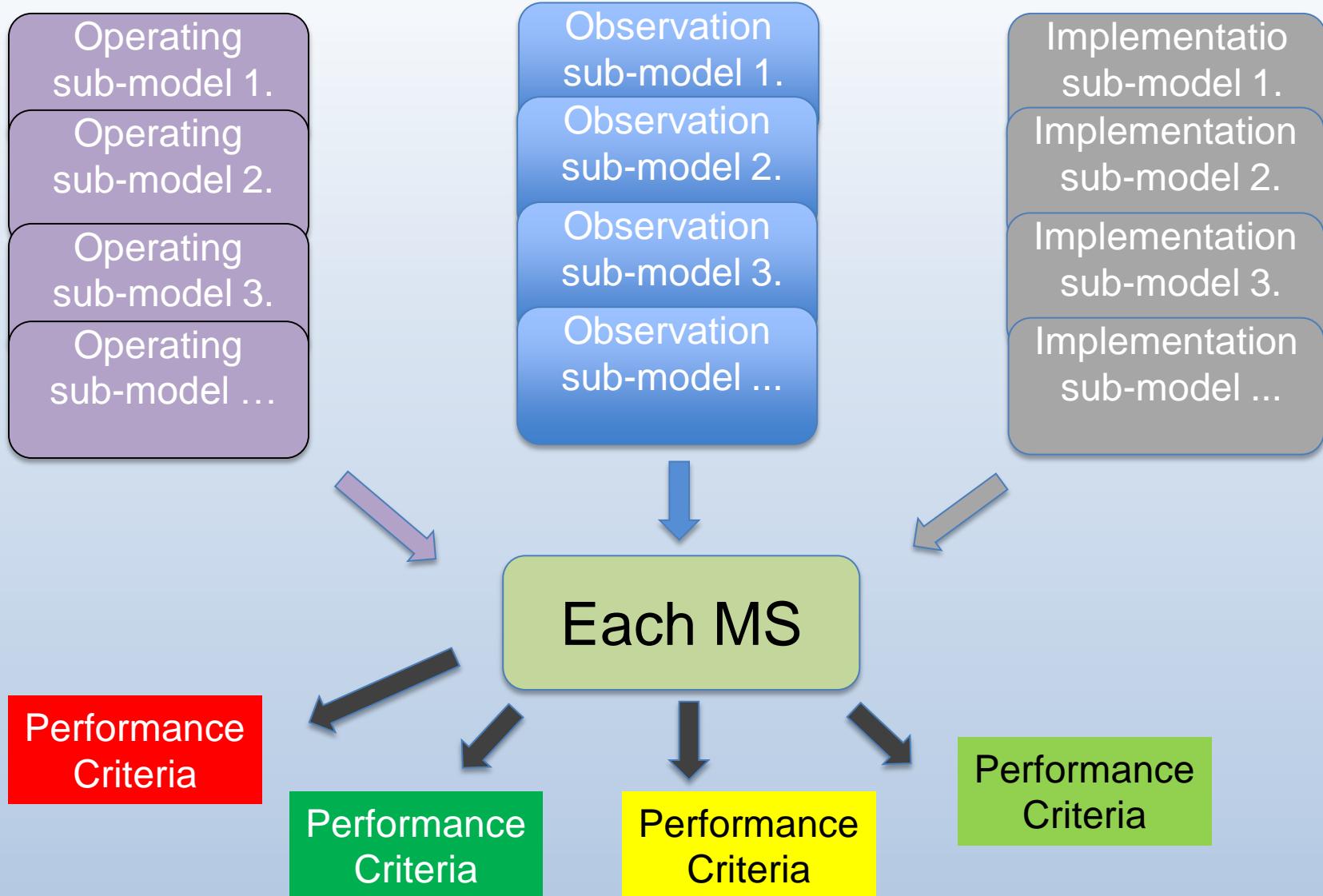
- Data

  $\left\{\begin{array}{l}\bullet \quad \text{Scientific survey} \\ \bullet \quad \boxed{\text{Catch, CPUE}} \\ \bullet \quad \text{Catch at age, CPUE}\end{array}\right.$

- Indicators of stock status

  $\left\{\begin{array}{l}\bullet \quad \text{Reference value} \\ \bullet \quad \boxed{\text{Production model derived}} \\ \bullet \quad \text{VPA derived}\end{array}\right.$

- Harvest Control rules

  $\left\{\begin{array}{l}\bullet \quad \text{Simple proportion} \\ \bullet \quad \boxed{\text{Target, Trigger, Limit Fishing Mortality}}\end{array}\right.$
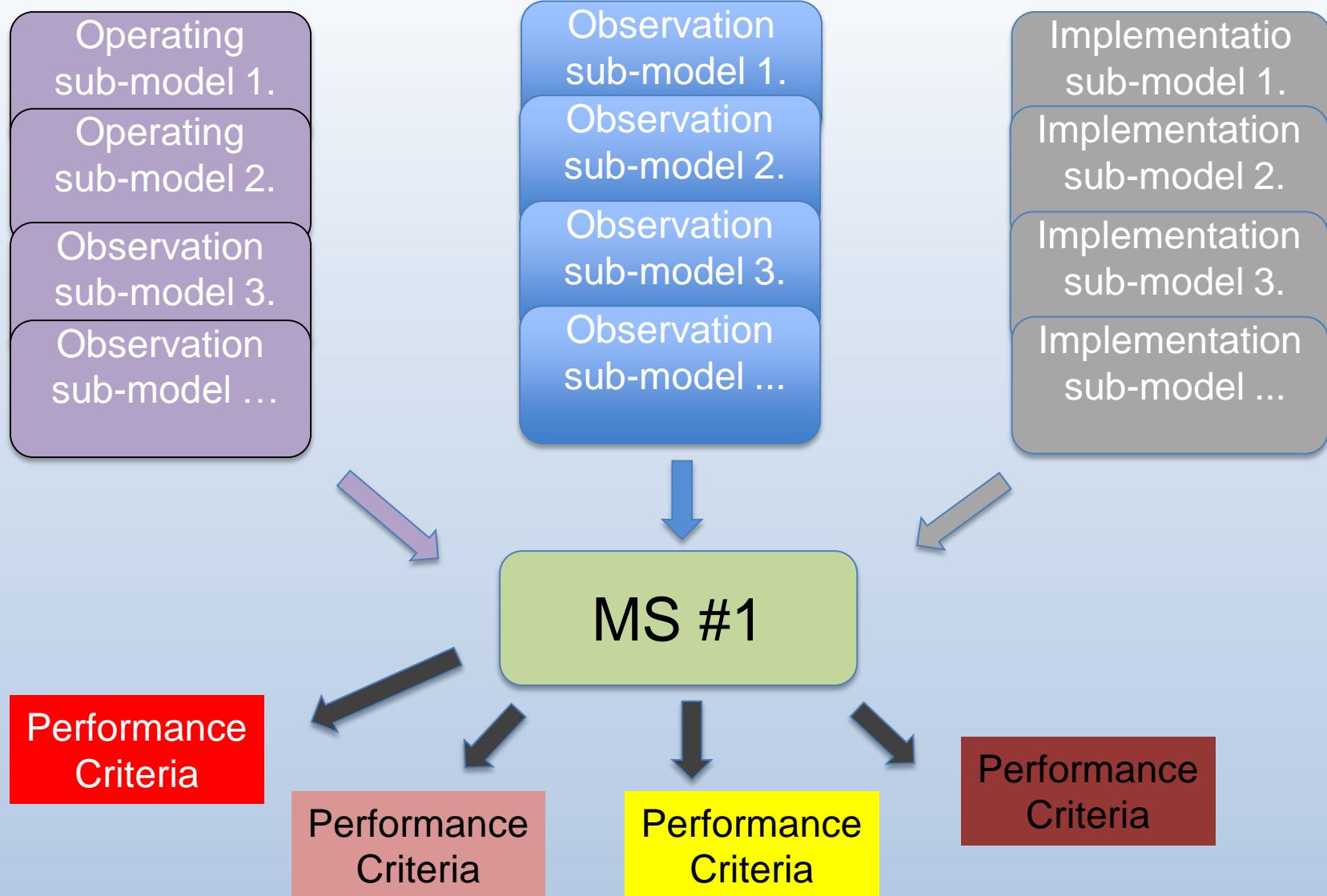
  $\boxed{\text{Candidate MS}}$

How do we test candidate MS?

SIMULATIONS

Operating sub-model — "true" Dynamics

Observation error sub-model — "observed" Dynamics

"Observed" data

Catch

Implementation sub-model

assessment sub-model

Performance Criteria

TAC

Perceived stock status
Pre-agreed actions (HCR)

Uncertainty

Operating sub-model 1.
Operating sub-model 2.
Operating sub-model 3.
Operating sub-model …

Observation sub-model 1.
Observation sub-model 2.
Observation sub-model 3.
Observation sub-model ...

Implementatio sub-model 1.
Implementation sub-model 2.
Implementation sub-model 3.
Implementation sub-model ...

Each MS

Performance Criteria

Performance Criteria

Performance Criteria

Performance Criteria

MS #1 – not so good

MS/MP #2 – not good enough

MS good- robust to uncertainty

Operating sub-model 1.	Observation sub-model 1.	Implementatio sub-model 1.
Operating sub-model 2.	Observation sub-model 2.	Implementation sub-model 2.
Observation sub-model 3.	Observation sub-model 3.	Implementation sub-model 3.
Observation sub-model …	Observation sub-model ...	Implementation sub-model ...

MS #3*

Performance Criteria

Performance Criteria

Performance Criteria

Performance Criteria

* It is the Commision that decides what is best!!!

SCRS progress on MSE simulations

– Albacore North [Rec 2015-04, 2015-07]

First full set of MSE simulations completed
Report on performance of alternative MS

– Bluefin tuna (GBYP) [2015-07]

Simulation framework developed
Supporting BFT assessment
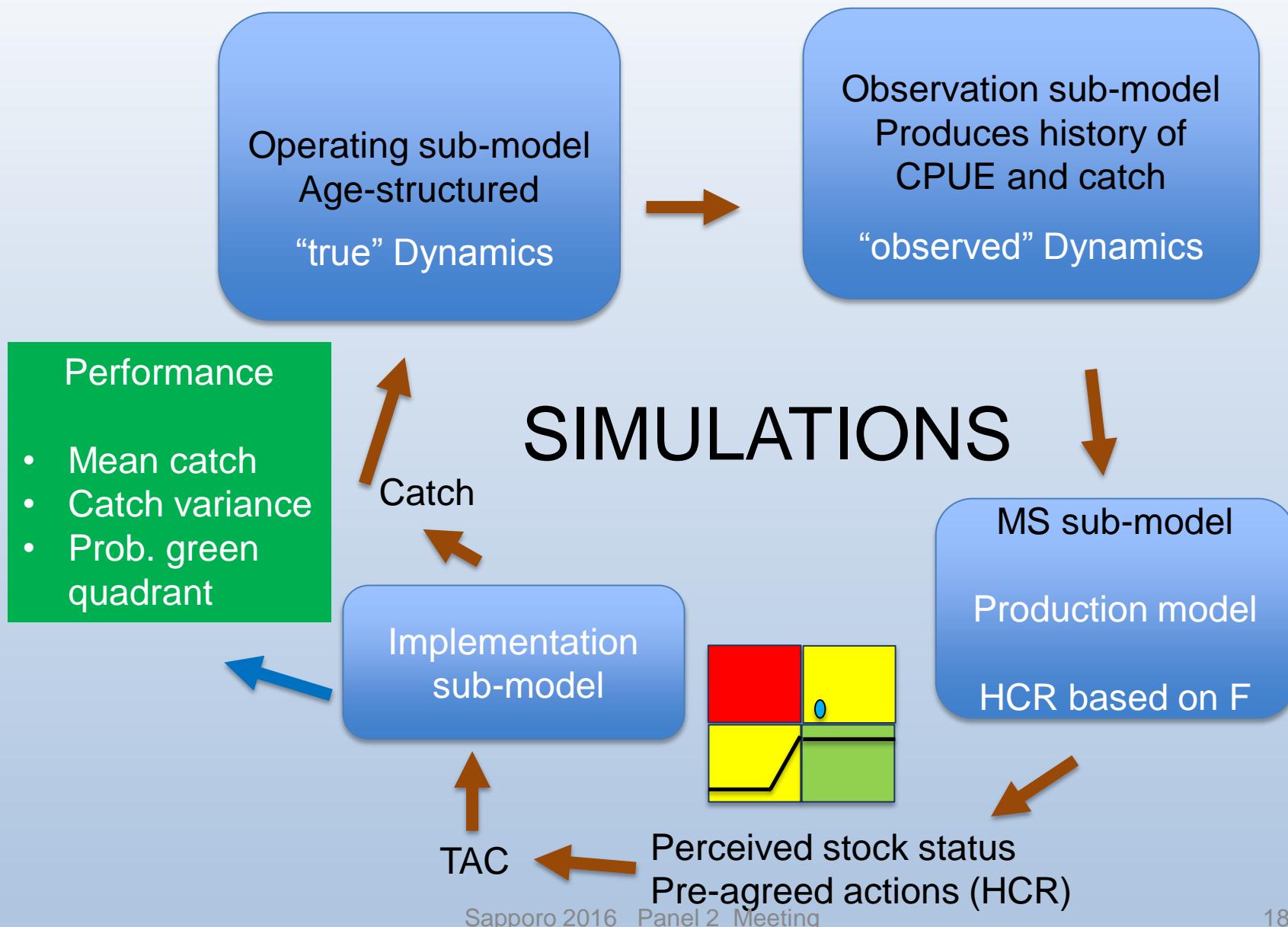
# Atlantic Albacore North

Full set of simulations conducted:
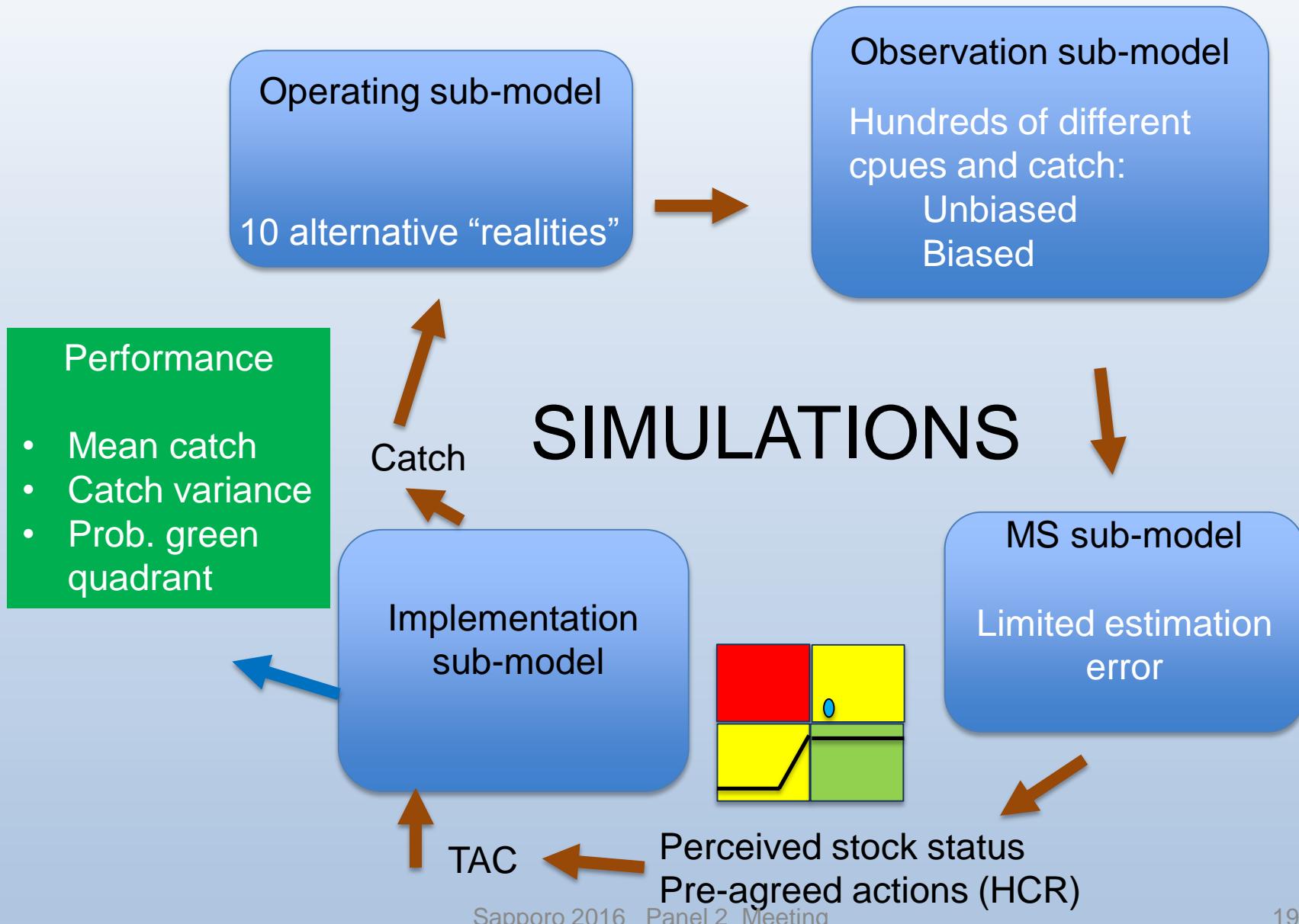
- Wide range of operating models
- Wide range of candidate HCRs
- Report on a set of Performance indicators

2016 Albacore MSE simulations

Incorporating UNCERTAINTY

Operating sub-model

10 alternative "realities"

Observation sub-model

Hundreds of different cpues and catch:
Unbiased
Biased

SIMULATIONS

MS sub-model

Limited estimation error

Implementation sub-model

Catch

TAC

Perceived stock status
Pre-agreed actions (HCR)

Performance

- Mean catch
- Catch variance
- Prob. green quadrant
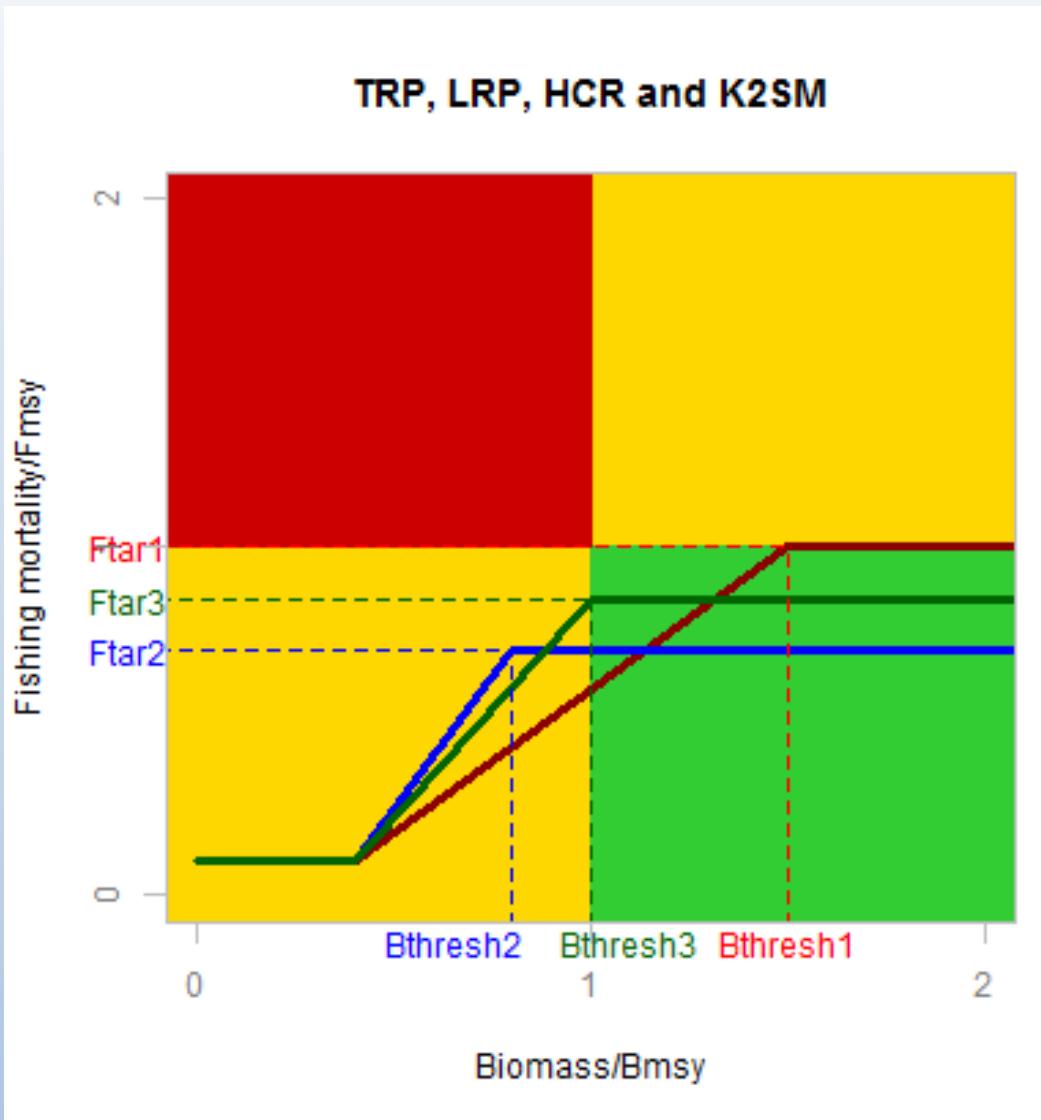
Candidate HCRs

Example: Initial
Albacore North
MSE
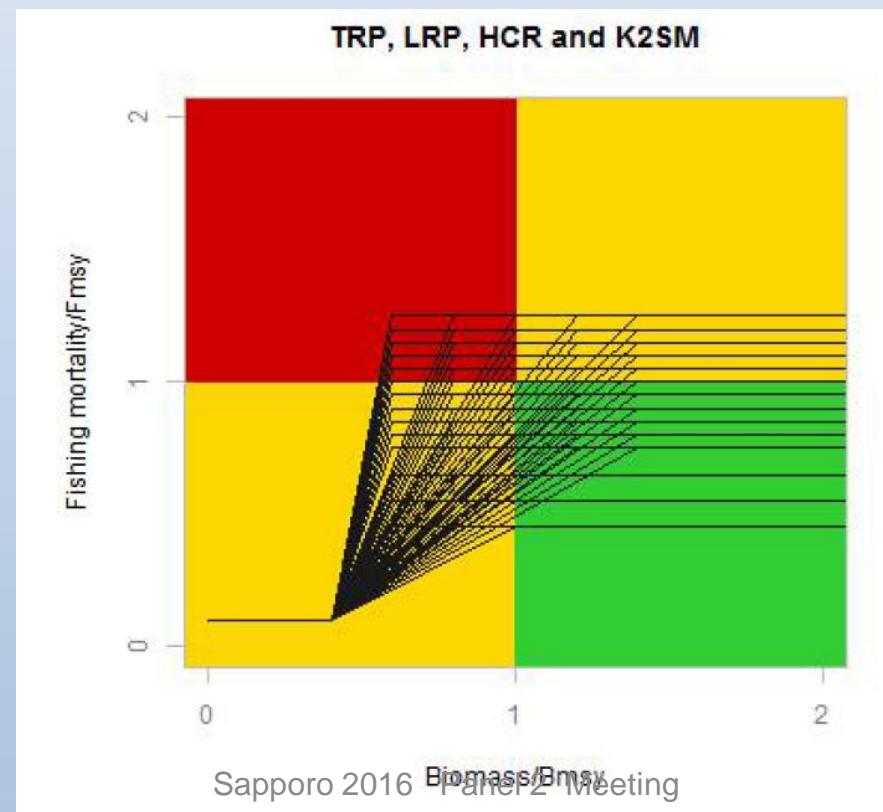
Three different HCRs

	$B_{treshold}$	F_{target}
HCR1	1.5	1.0
HCR2	1.0	0.85
HCR3	0.85	0.75

TRP, LRP, HCR and K2SM

Full set of HCRs tested
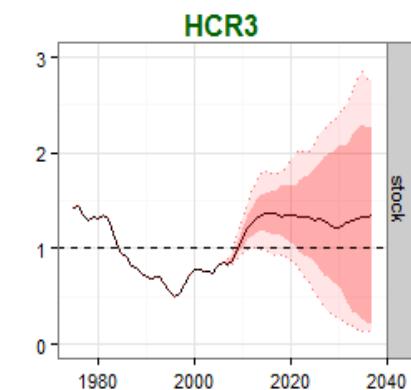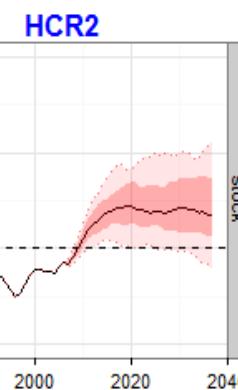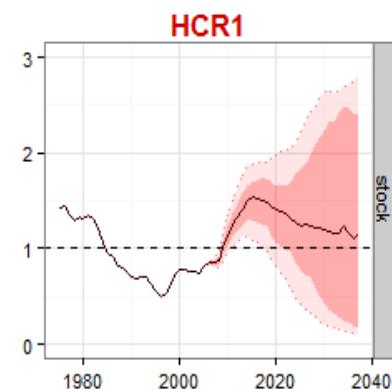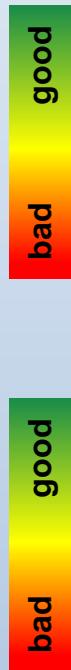
|		F target												
		0.45	0.55	0.65	0.75	0.80	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.20	1.25
B threshold	0.6	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
	0.8	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	1.0	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.2	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	1.4	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗

TRP, LRP, HCR and K2SM

Fishing mortality/Fmsy

Biomass/Bmsy
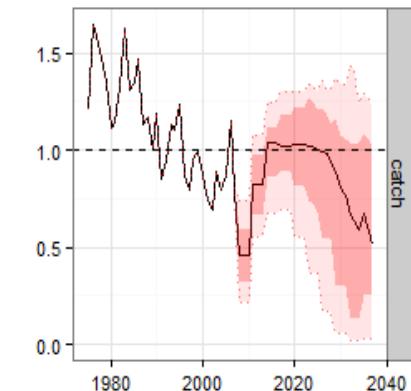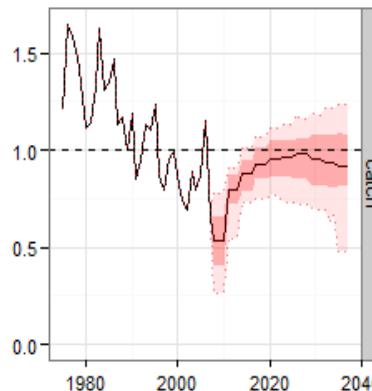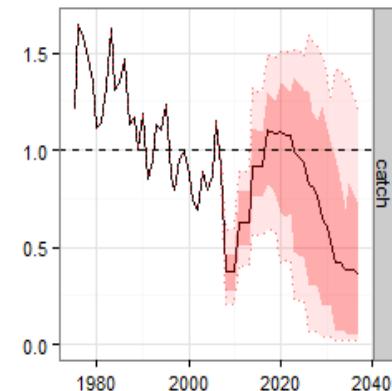
# Predicted state of stock and catch

Characterizing Uncertainty
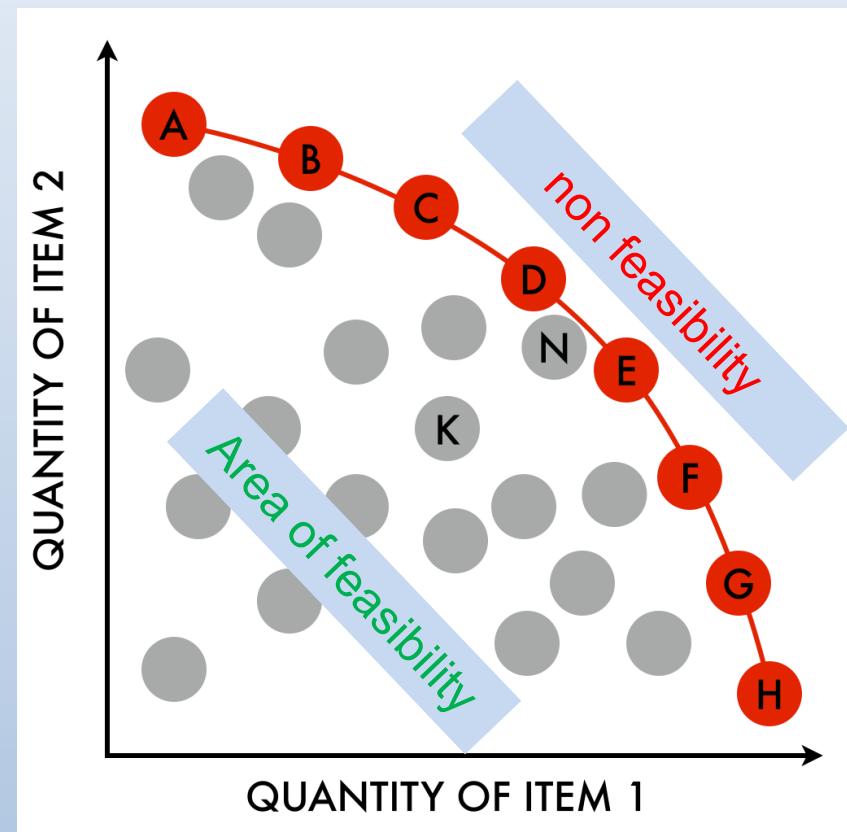
Presenting performance of MS

A **Pareto frontier** is a set of choices in which it is impossible to improve the performance of one variable without worsening the other.

Trade-offs between two criteria:
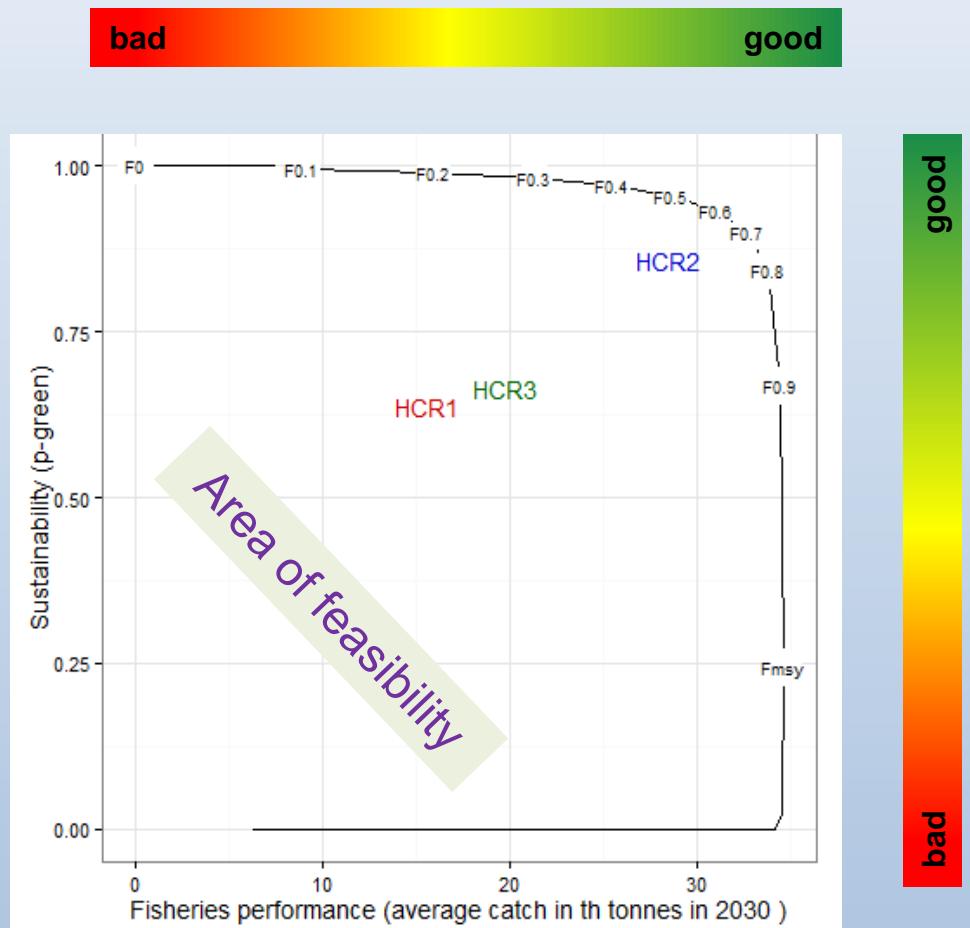
**Mean catch
Vs
Prob of Green quadrant**
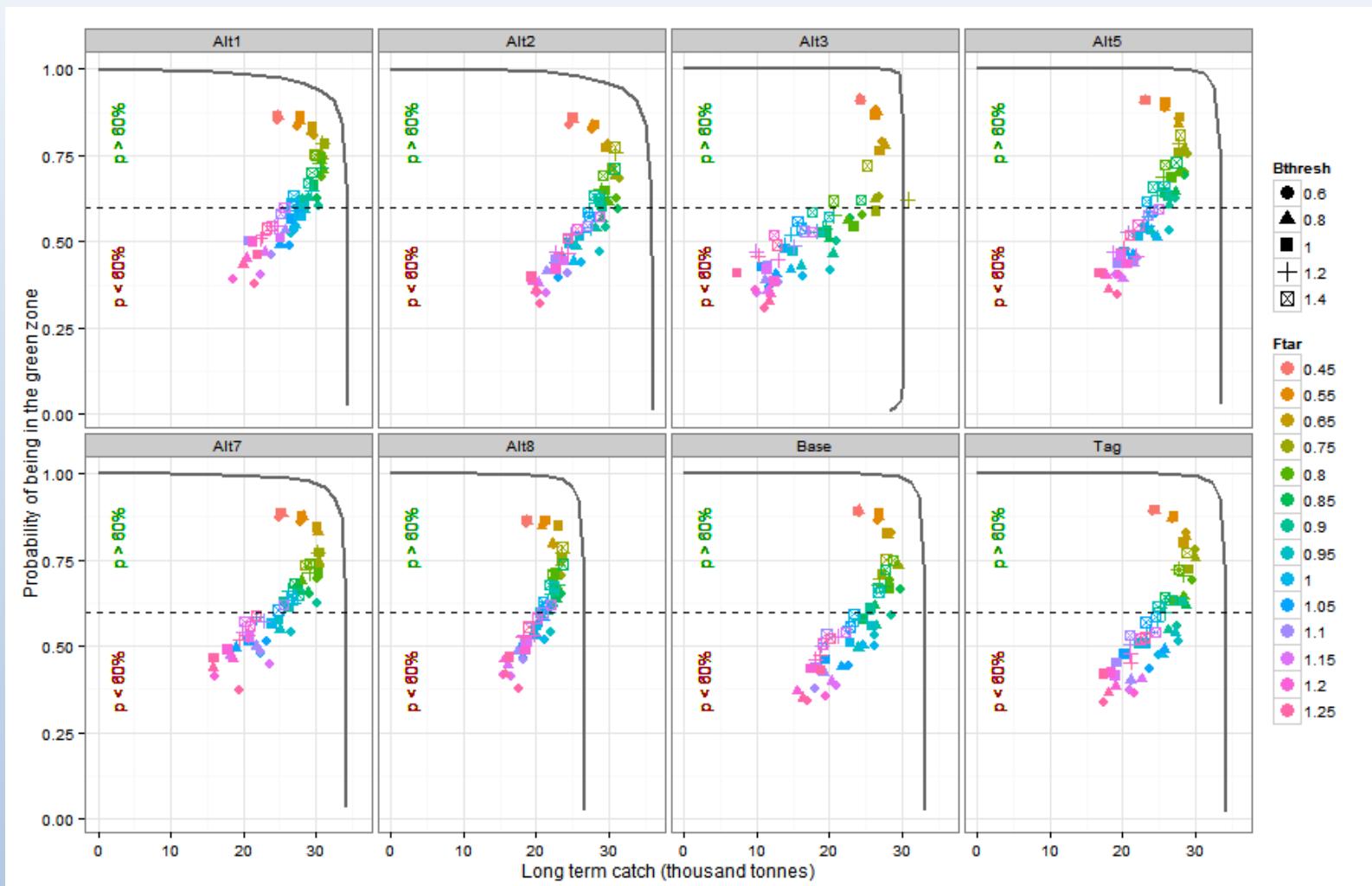
Evaluating performance of 3 HCRs on basis of :

- Mean average catch
- Probability of being on the green
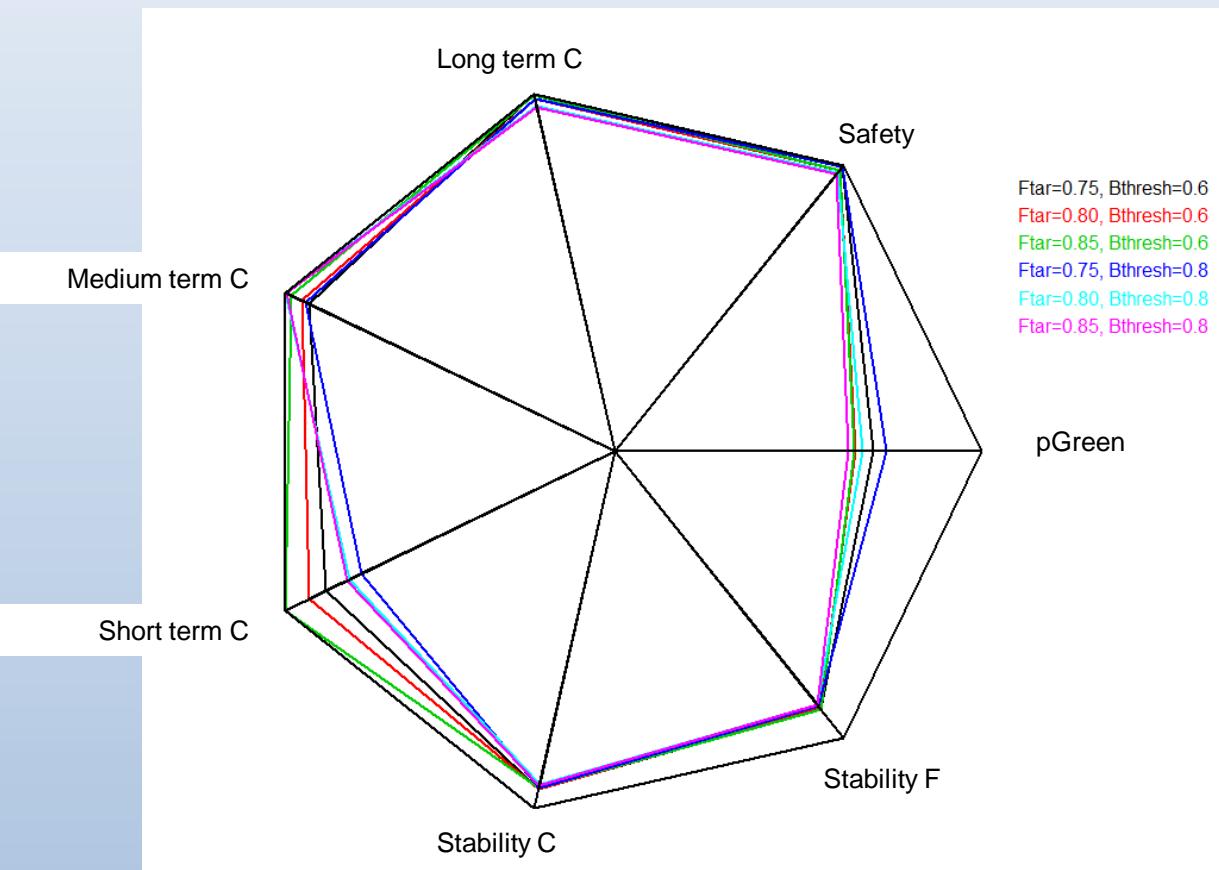
Example:Initial Albacore North MSE

# 2. Results

2. Results (candidate HCRs)

Radar chart with axes: Long term C, Safety, pGreen, Stability F, Stability C, Short term C, Medium term C

Legend:
- Ftar=0.75, Bthresh=0.6
- Ftar=0.80, Bthresh=0.6
- Ftar=0.85, Bthresh=0.6
- Ftar=0.75, Bthresh=0.8
- Ftar=0.80, Bthresh=0.8
- Ftar=0.85, Bthresh=0.8
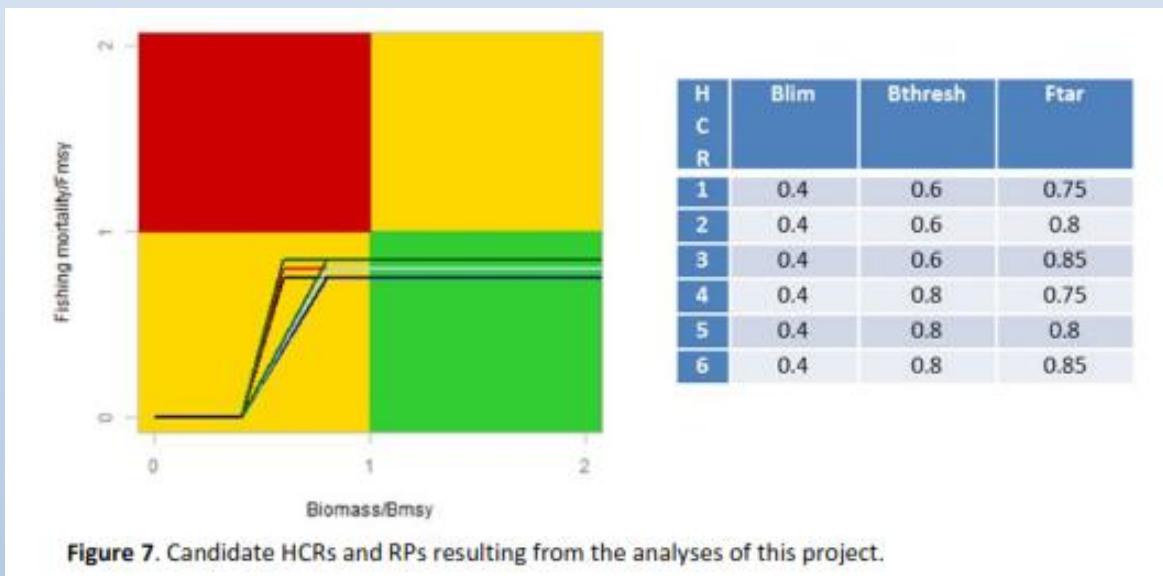
1. Discard HCRs if pGreen < 0.6 (Rec 15-04)

2. Ftar with high yield

3. Select Bthresh that will avoid drastic reductions of catch

2. Results (candidate HCRs)

1. Discard HCRs if pGreen < 0.6
2. Ftar with high yield
3. Select Bthresh that will avoid drastic reductions of catch

"More precaution and less action"

HCR	Blim	Bthresh	Ftar
1	0.4	0.6	0.75
2	0.4	0.6	0.8
3	0.4	0.6	0.85
4	0.4	0.8	0.75
5	0.4	0.8	0.8
6	0.4	0.8	0.85

Figure 7. Candidate HCRs and RPs resulting from the analyses of this project.

ALBN :Conclusions so far

- Pareto frontiers and spider diagrams can be used as effective reporting tools to evaluate the trade-offs between 2 or more management objectives.

- MS based on surplus production models and simple HCRs can be useful to deliver robust advice in this fishery.

- The HCRs that perform better include moderate levels of precaution (Ftarget< 0.8 Fmsy) and a delayed reaction to stocks falling below Bmsy (0.6 < Bthresh < 0.8 Bmsy)

ALB N Future Steps

-

- Future work required from SCRS depends on resources made available. Work to date has been largely funded by contract from EU and the ICCAT secretariat

  Discuss: Should there be another mechanism to advance this process? What resources can we use to add change the mechanism used to advance this work?

-
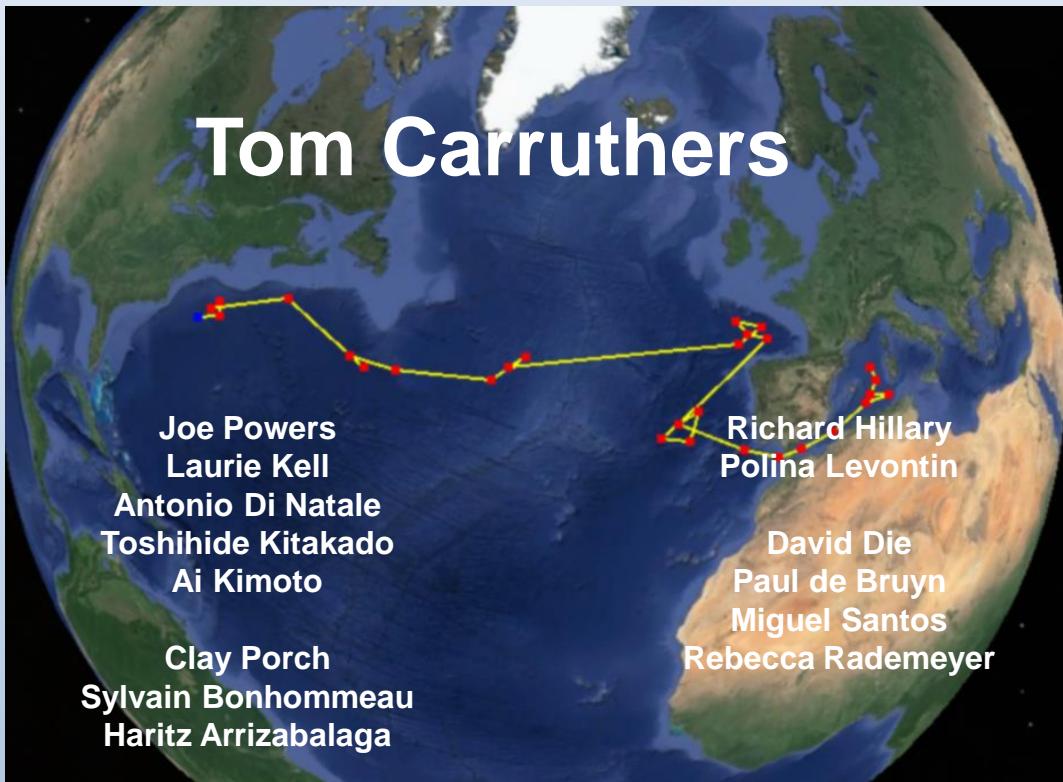
Panel 2 feedback ALB N

- Is the list of performance indicators used enough/excessive?

- Are the data/method components of the tested MS appropriate?

- Is the range of HCR tested appropriate? Should we narrow it?

- Are the Pareto plots and Spider diagrams useful to evaluate performance of MS?

- What additional work does the panel need (dependent on resources available to do it)
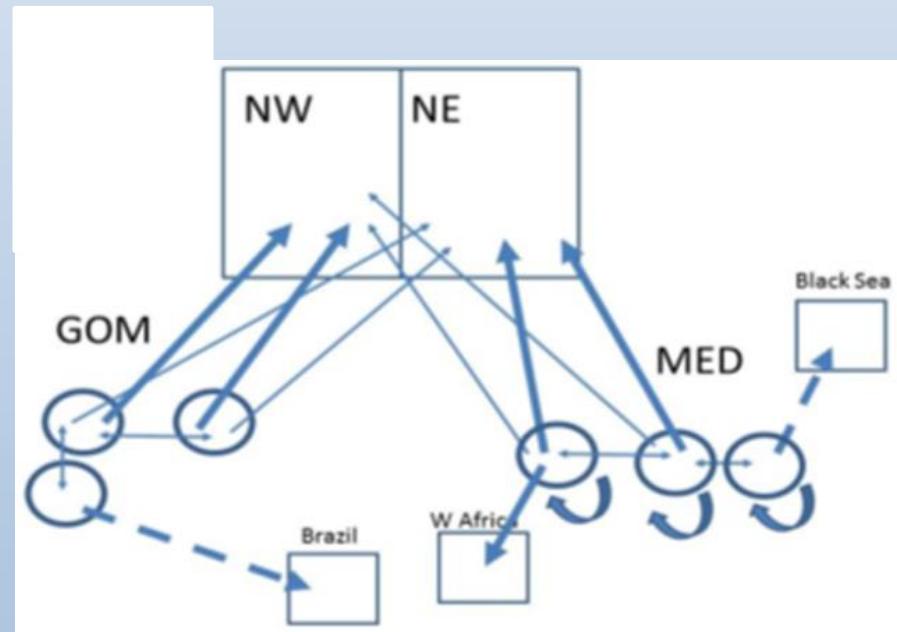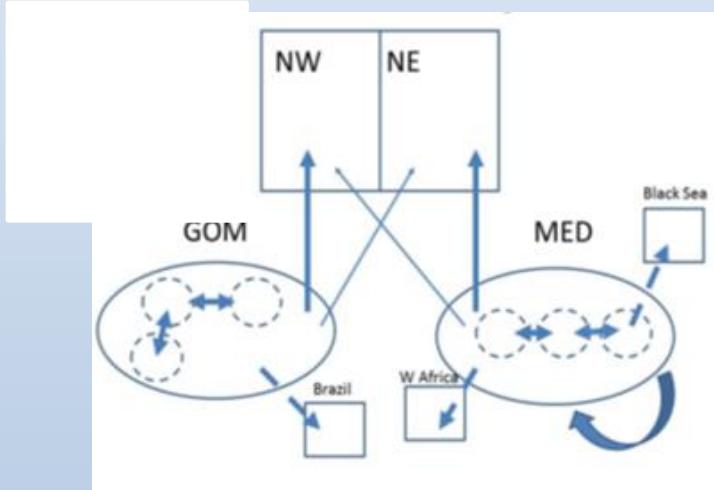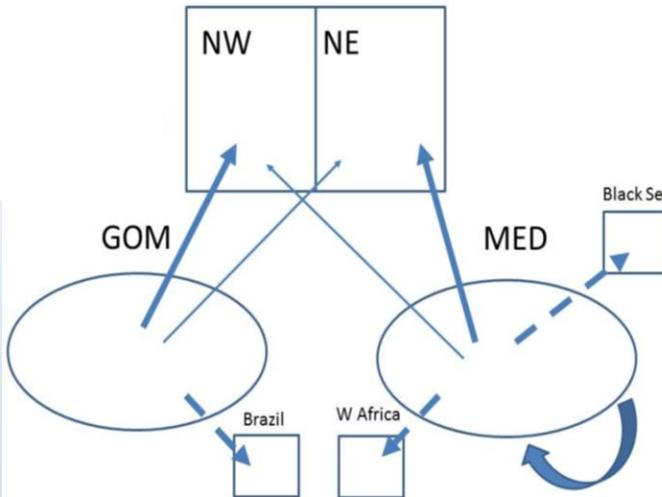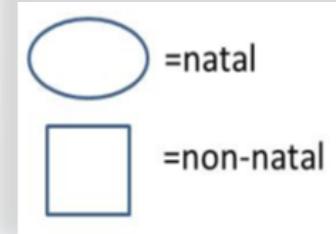
MSE BFT (GBYP)

- Flexible operating model
- Can accommodate a wide range of candidate MS/MPs

Tom Carruthers

Joe Powers
Laurie Kell
Antonio Di Natale
Toshihide Kitakado
Ai Kimoto

Richard Hillary
Polina Levontin

David Die
Paul de Bruyn
Miguel Santos
Rebecca Rademeyer

Clay Porch
Sylvain Bonhommeau
Haritz Arrizabalaga
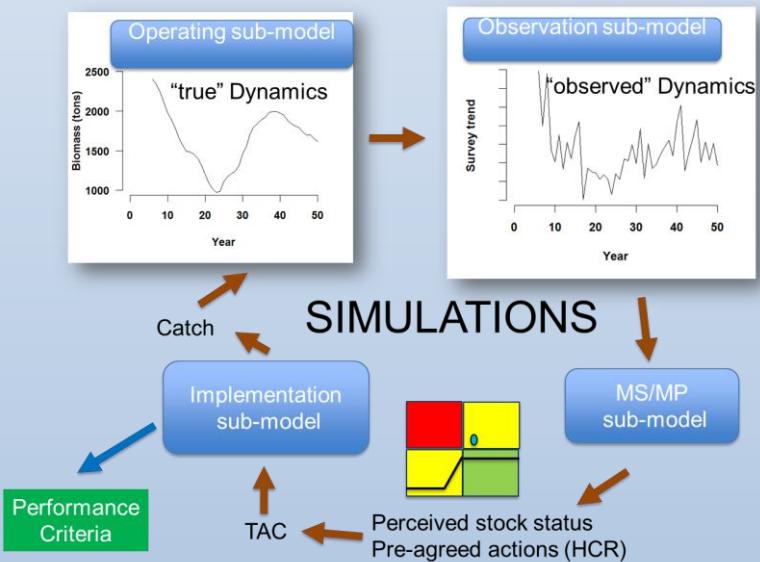
Need a model that can account for a wide range of hypotheses regarding stock structure and mixing


Arrizabalaga et al. 2014

BFT MSE: capturing hypotheses

- Developed a multi-stock, spatial, quarterly, statistical catch-at-length model (M3)
- Move away from catch-at-age data
- Finer spatial resolution
- Run much faster than previous multi-stock models
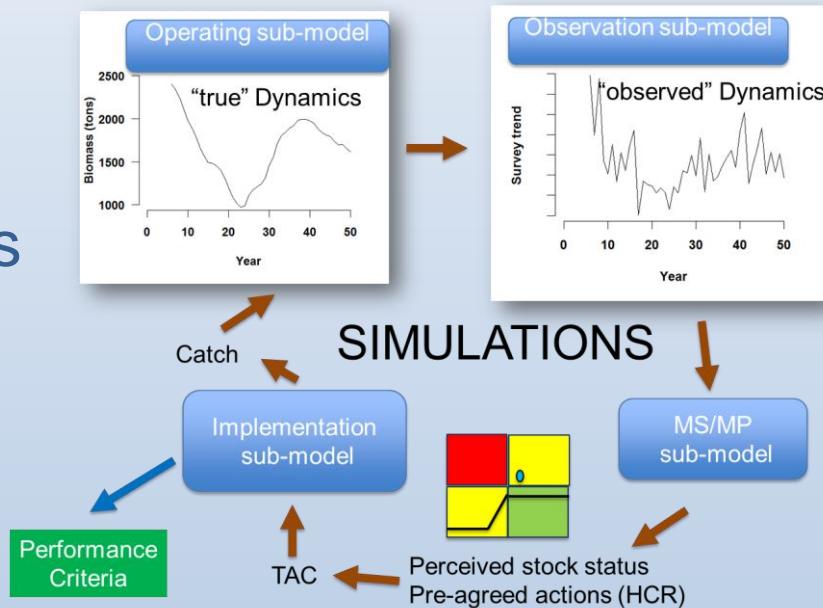
Candidate assessment models and HCRs

Assessment models:

- VPA
- Delay-difference model
- Spatial delay-difference
- Spatial production
- Southern bluefin tuna MPs
- custom MPs (30+)

Harvest control rules

- 40-10
- percentile of FMSY
- Empirical (CCSBT Style)
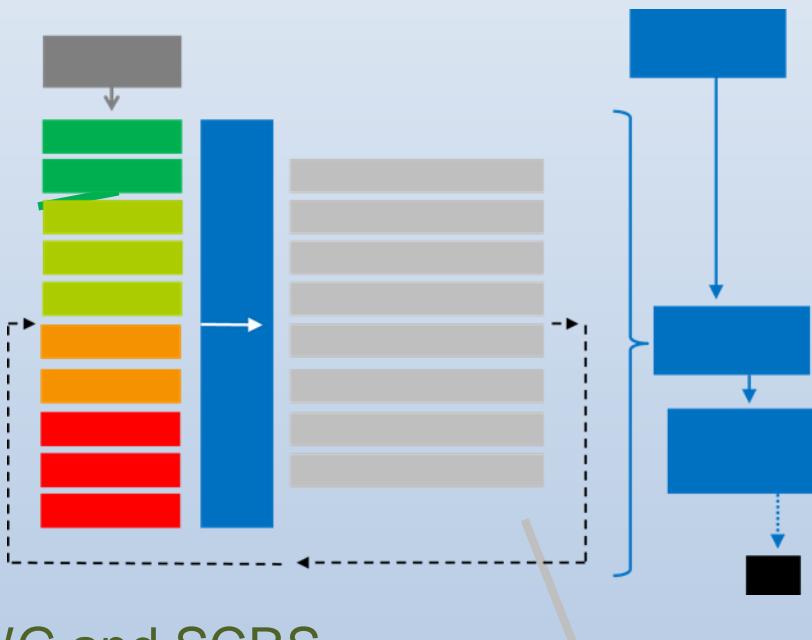
BFT MSE: future steps

DATA PROVIDERS:

SNPs, otolith microchemistry, otolith shape, mitochondrial DNA

Standardized catch-rate indices

PSAT tags, archival tags

Panel 2: Performance metrics and HCRs

BFT WG and SCRS

Develop/review hypotheses on operating models

Test performance of alternative assessment models

Develop candidate MS/MPs

Conclusions MSE BFT

- Very flexible framework developed
- Interim objective is to use MSE framework for improving current stock assessment
- Conditioning of model requires validation by BFT WG (next week)
- Testing of new assessment models to support 2017 assessment of BFT
- After 2017 – use framework for full MSE

Panel 2 feedback BFT N

- Is the list of alternative operating models available enough/excessive?

- Are the data/method components available in the framework appropriate?

- Is the range of HCR available for testing appropriate?

- Are the Pareto plots and Spider diagrams useful to evaluate performance of MS?

- Are the resources devoted through the GBYP adequate for this work, how important is this part of the GBYP in relation to others