EPO BET MSE Development

3rd IATTC Tropical Tuna MSE Workshop, *by videoconference*, December 08-09, 2022

MSE flavors (Andre Punt's talk)

- When an MSE is an MSE, when a MP an MP?

A "true" management strategy would pre-specify all aspects of data collection, data analysis, and HCR.
Only in South Africa, IWC, Greenland halibut, CCSBT and IOTC BET are all (or almost all) aspects of data analysis pre-specified.

The Good: The management strategies to be evaluated should be "realistic" and "implementable" and must fully document which data will be collected, how the data will be analyzed, and HCR that **will** be applied.

The Bad: Assuming management has perfect information about things it could not have perfect info about.
The Badder: Testing "unimplementable" strategies such "fishing mortality = $0.1yr^{-1}$"
The Baddest: Testing an estimation method that differs from the real estimation method (e.g. test a production model when the actual estimation method is an age structured model).

MSE not appropriate for these situations

The Ugly: It is (almost) never possible to test the estimation method perfectly. Approximating the estimation method is not "ideal" practice, but often the best that can be done. How much approximation before the ugly becomes the bad?

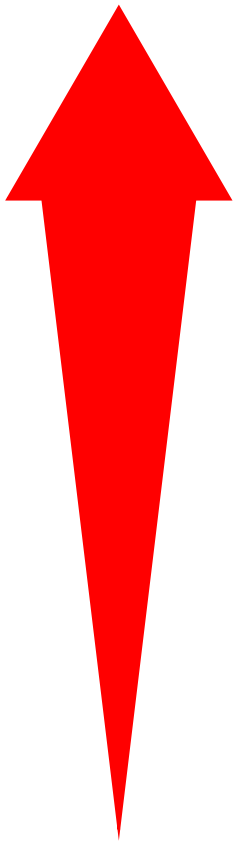
MSE can be used in this situation, although it is a more complex process than for the "good" case

Level of specification

Management Procedure

HCR with "likely" assessment

HCR, but no estimation method



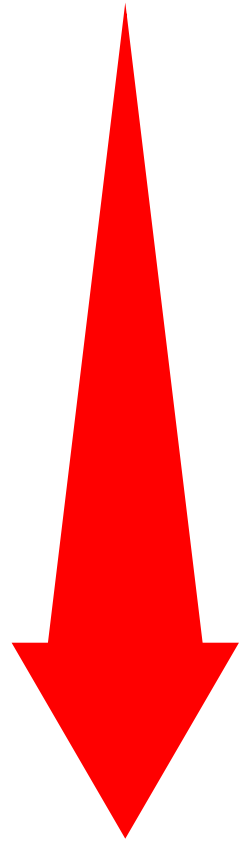
Type of management strategy

Empirical approach

Empirical approach with incompletely specified data

Vague model-based approach

Complexity of evaluation



Alternative HCRs (Model based and Empirical)

- **Empirical Rule**
  - Minimum treatment of data
  - Easy to compute, explain and understand
  - Care required to minimize responses to noisy data
- **Model-based Rule**
  - Based on models of varied complexity (e.g. assessments)

Empirical vs. Model-based strategies

Model-based management strategy:

- *The management strategy includes an explicit population dynamics model component and hence there are explicit "estimation" and "harvest control rule" components to the strategy [e.g. the IWC's RMP and the Strike Limit Algorithm for bowhead whales)*

Empirical-based management strategy:

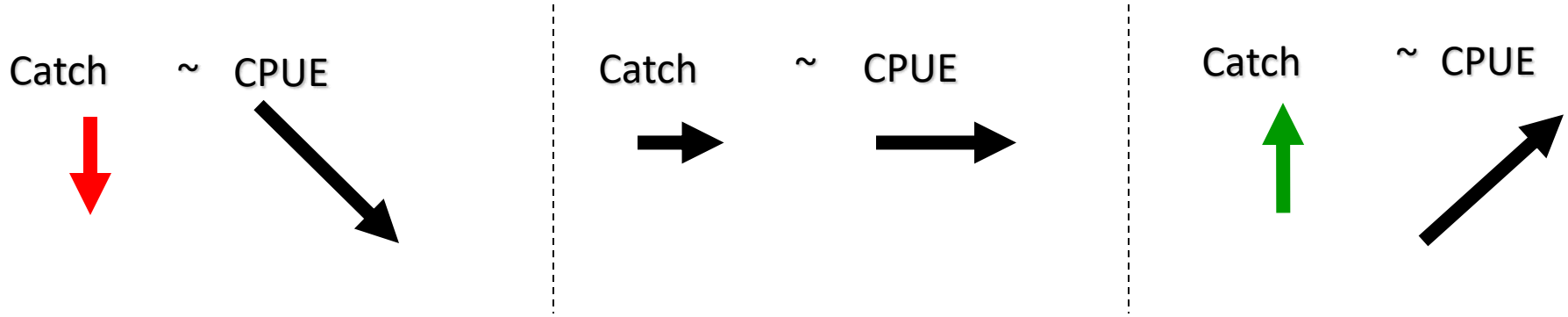
- *The management strategy is based on data collected directly from the fishery. Monitoring data are not analysed in the context of a population dynamics model, but may be pre-processed (e.g. CPUE standardized).* (e.g. the NAFO MP for Greenland halibut, MPs for South African fisheries, strategies for Australian data-poor situations)

Differences between the two types of strategies can be minor as performance is often similar between them, but empirical management strategies can often be easier to explain to stakeholders and test using MSE.

Empirical Harvest Control Rules

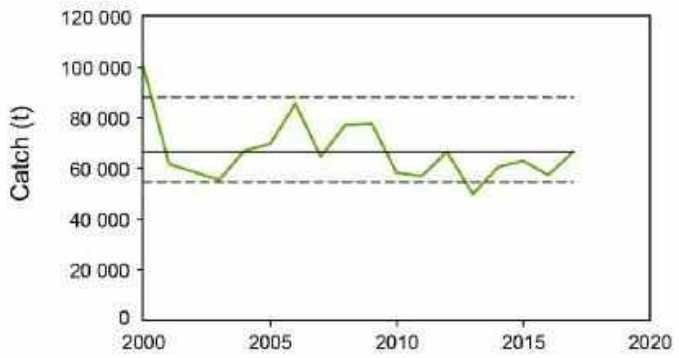
- Based on monitoring and feedback
- Simple rule, even when evaluation of its performance uses complex computer simulations (such as MSE)

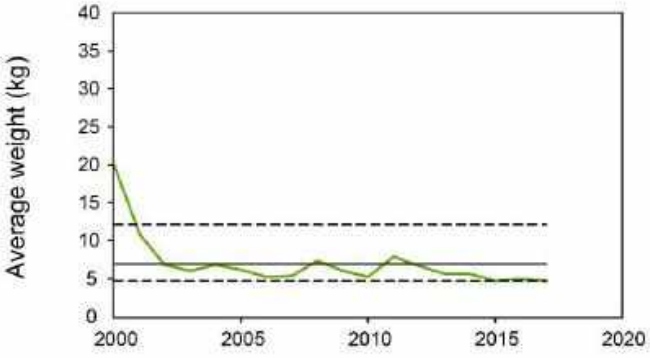
Example: adjust catch using CPUE trends



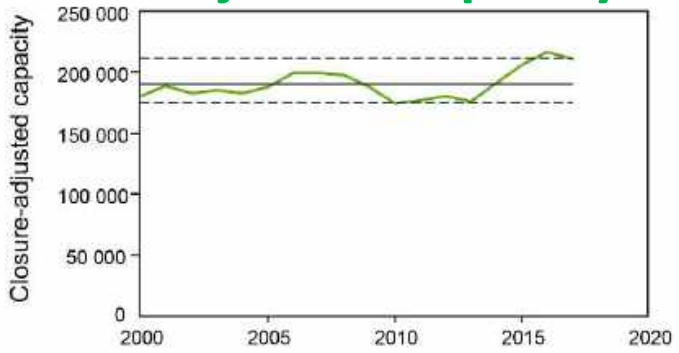
Indicators EPO Bigeye tuna

Standardized Japanese longline CPUE index



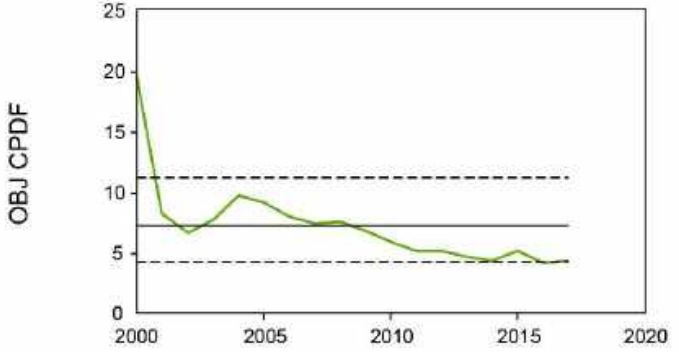


adjusted-capacity



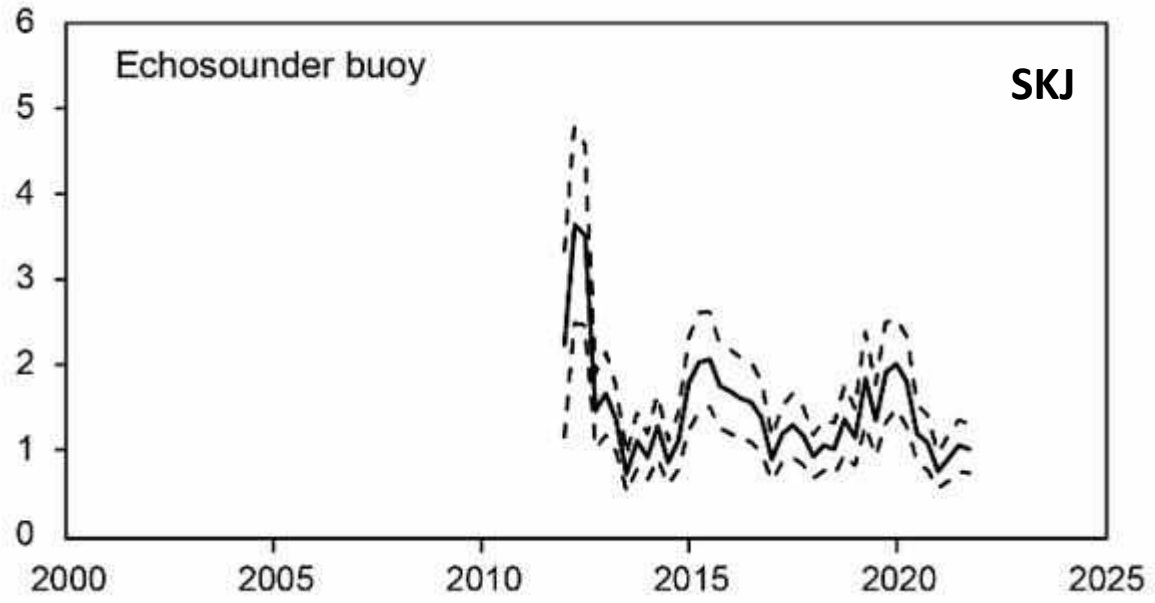
number of sets

CPUE



days fished

Future potential Indicators (Buoy index?)



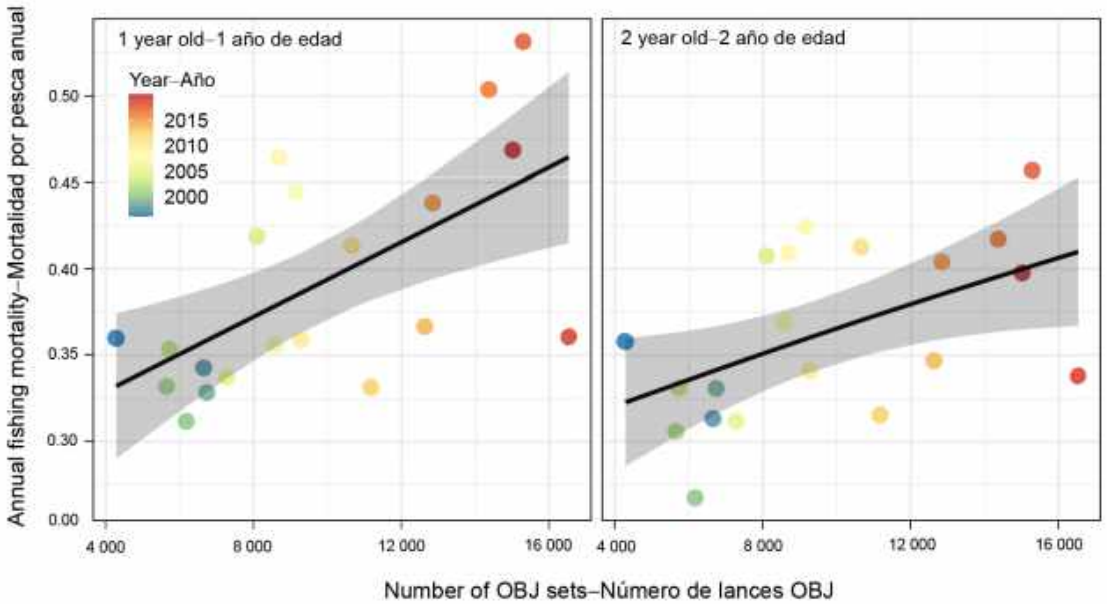
Species partitioning and BET index availability?

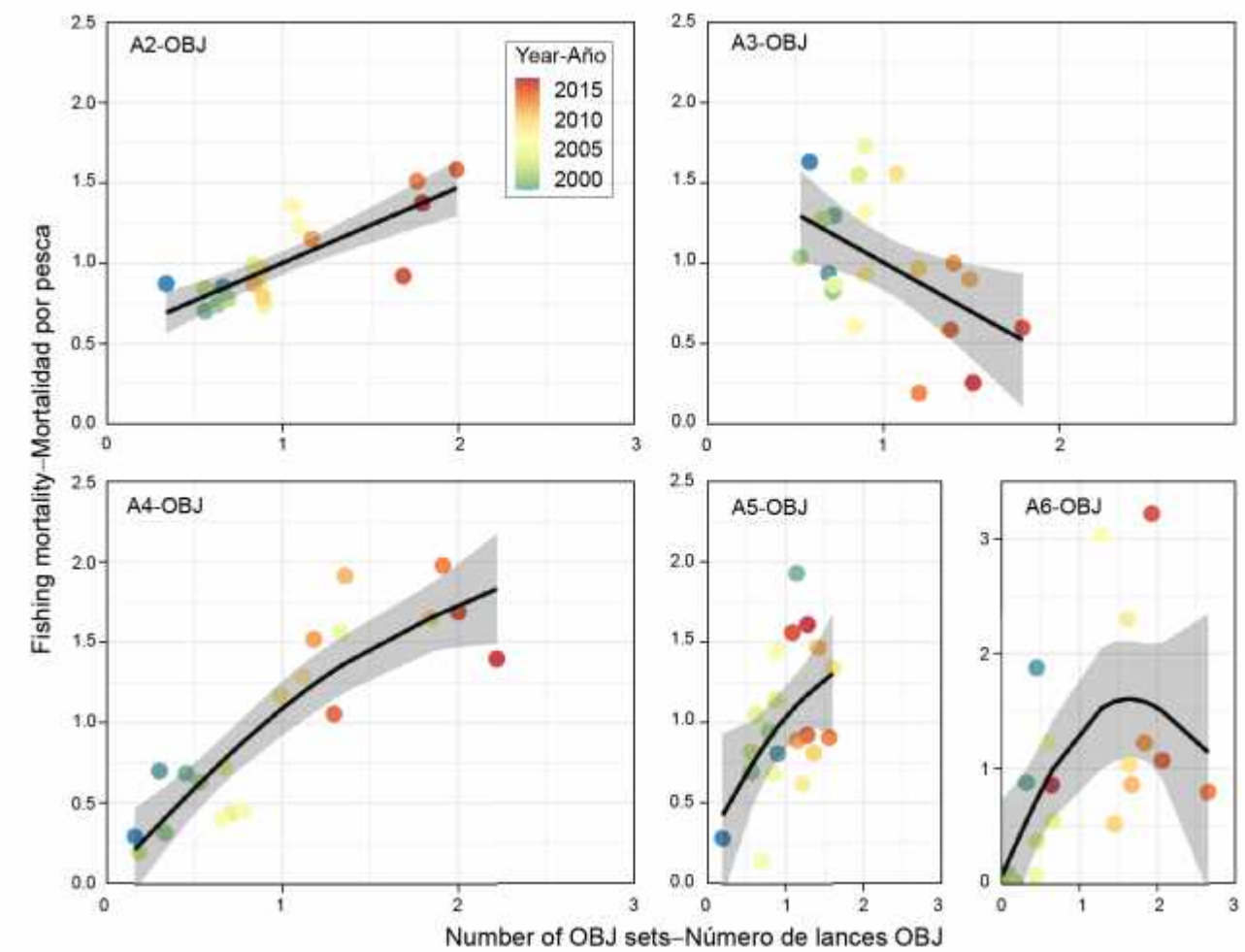
Size/age selectivity? Composition data?

Implementation error (days of closure vs *F*)

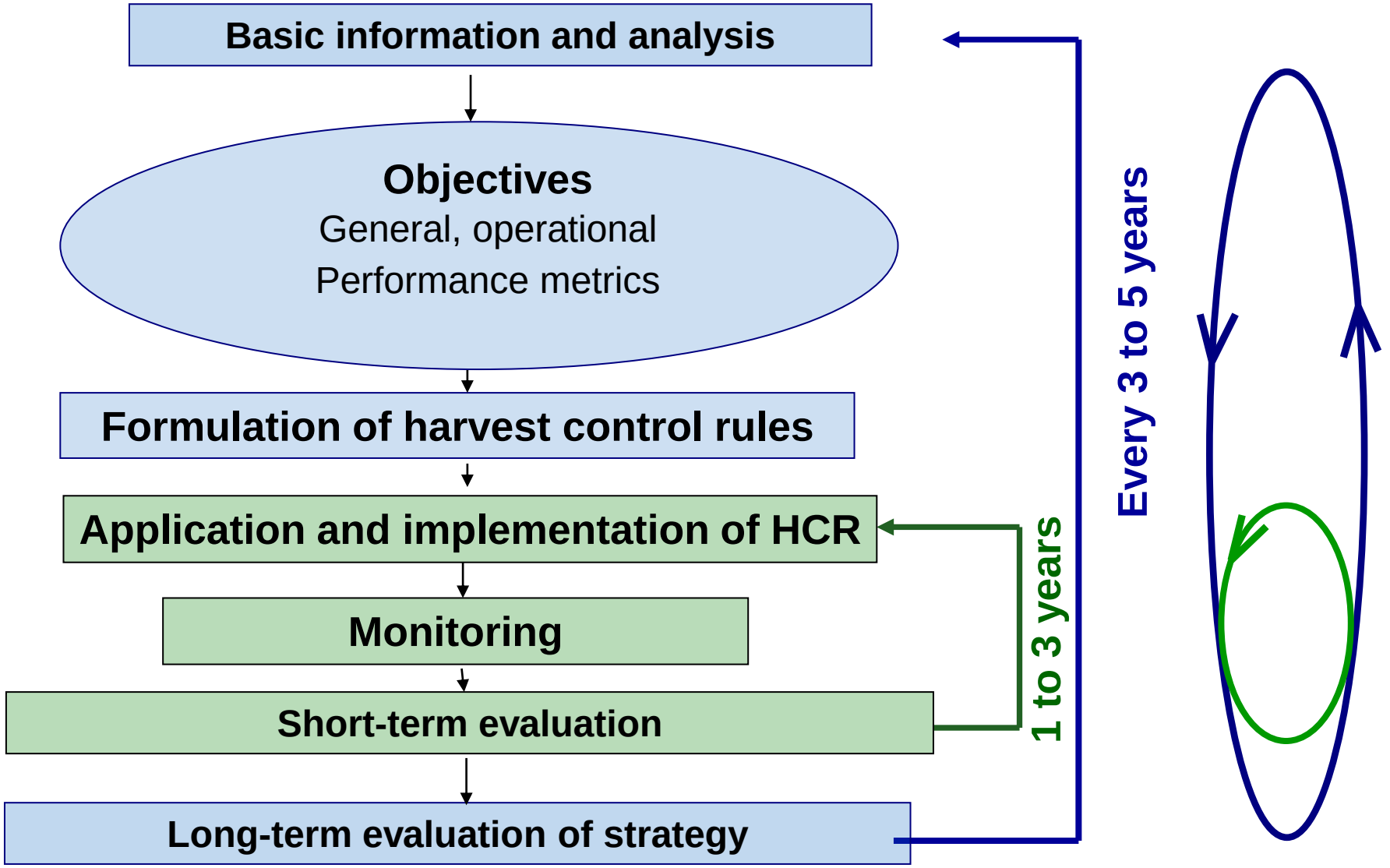
Rick Deriso's formula between Fishing mortality and closure days. Uncertainty around it?

Other relevant relationships (*F* and number of OBJ sets) and their uncertainty





Feedback cycles



Potential chromogram of harvest strategy implementation

	2023	2024	2025	2026	2027	2028	2029	2030
SAC	First round MSE	Second round MSE						
AM		Select/Adopt BET MP						
AM		Set Measures (2025-2027)			Set Measures (2028-2030)			Set Measures (2031-2033)
Staff work	Collate data for MP			Collate data for MP			Collate data for MP	
Staff work	Run MP			Run MP			Run MP	
Staff work	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.	Check Excep. Circumst.
Staff work		Assess stock status			Assess stock status			Assess stock status

Role of full stock assessment model in Management Strategy

- As only Estimation Model of Management Strategy
  - Logistically and computationally impractical

- As Estimation Model of Management Strategy with adjustments in between cycles

- Decoupled from Management Strategy and HCR implementation or MP
  - Stock status determination relative to reference points
  - Operating model development and modeling research
  - Check exceptional circumstances and meta rules

Management Strategy: rules and meta-rules

Every year

Every 3 years

Review of stock and fishery indicators

Exceptional circumstances?

In depth stock assessment

Exceptional circumstances?

no

yes

no

yes

Apply MP-derived TAC

If exceptional circumstances, advise on other measures

no

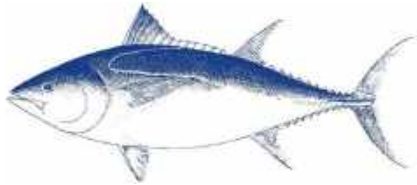
Are exceptional circumstances so severe that immediate action on TAC is required?

yes

Invoke metarule

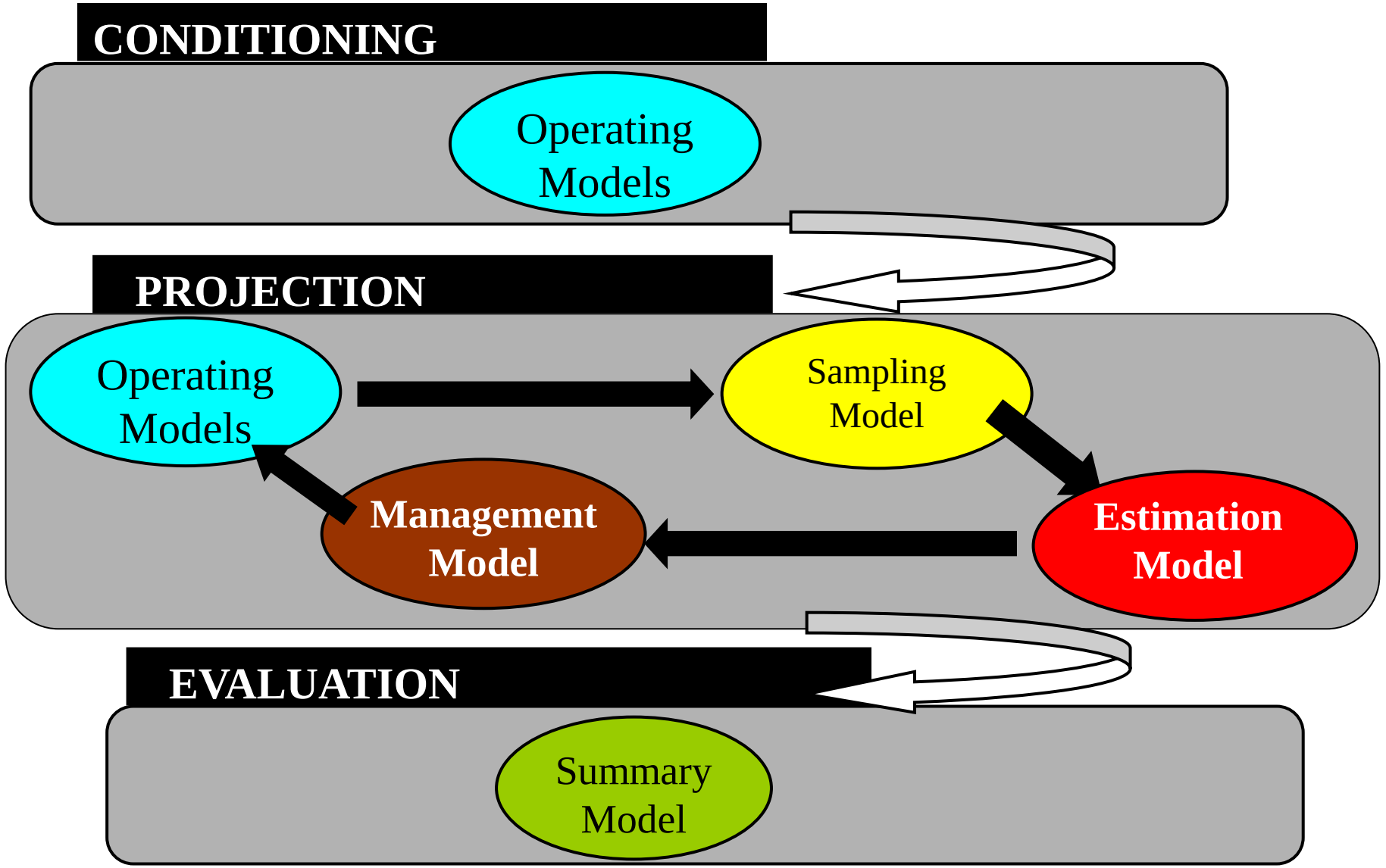
Do not apply MP-derived TAC

Advise on TAC

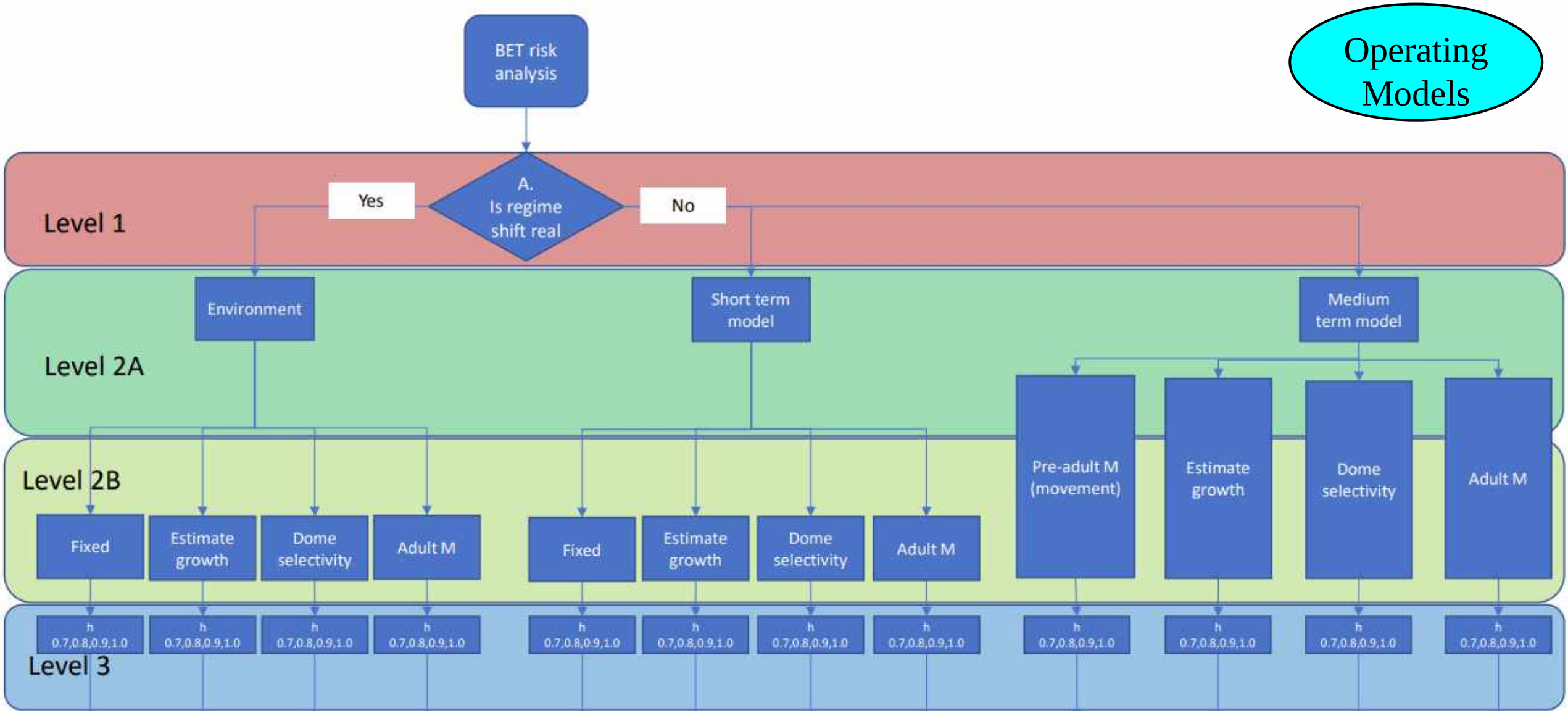


Southern Bluefin Tuna (CCSBT)

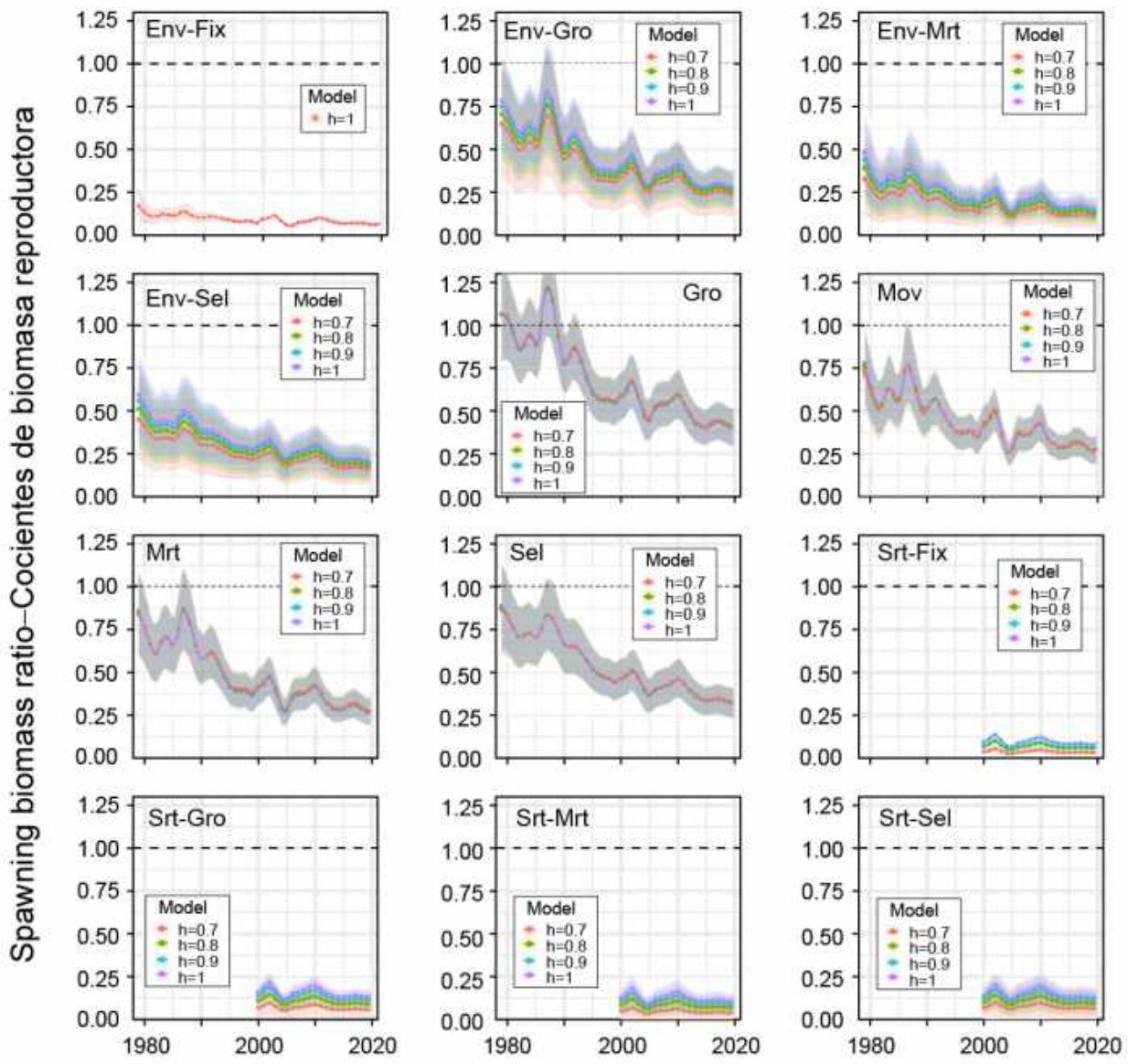
Management Strategy Evaluation: Components



Hypotheses for conditioning BET Operating Models

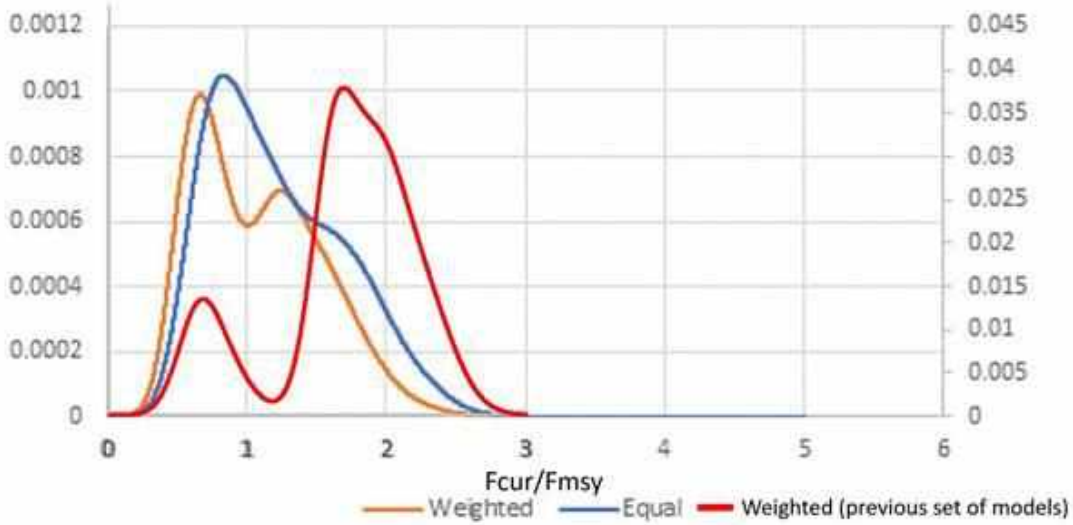


Sample design for OMs from BET reference models



Operating Models

Alternative weightings



Alternative EMs for BET (simpler assessment model)

- ASPM in Stock Synthesis
- Pella-Tomlinson model
- Gear-aggregated simpler integrated model in Stock Synthesis
- Others?

Harvest Control Rules for BET MSE

- Tropical Tuna Harvest Control Rules (Resolution C-16-02)

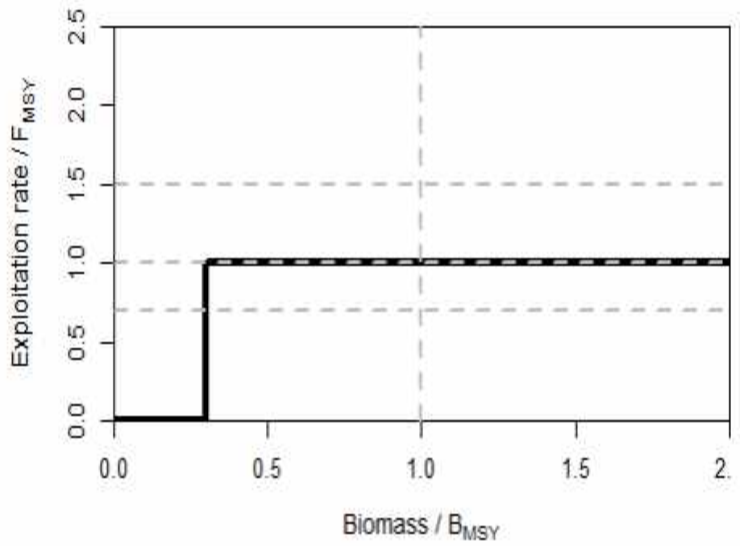
"…comprehensive management strategy evaluation (MSE) is necessary to evaluate the HCR (…) and alternatives (…) to allow the Commission to adopt a permanent HCR."

ALTERNATIVE HCRs

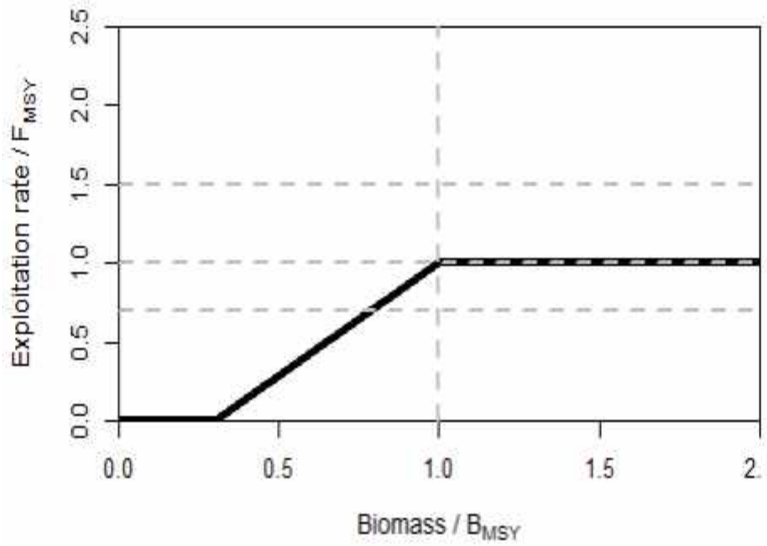
1) Empirical HCR based on standardized Japanese longline index of abundance

2) Model based HCR, based on surplus production model (ASPM, Pella-Tomlison)

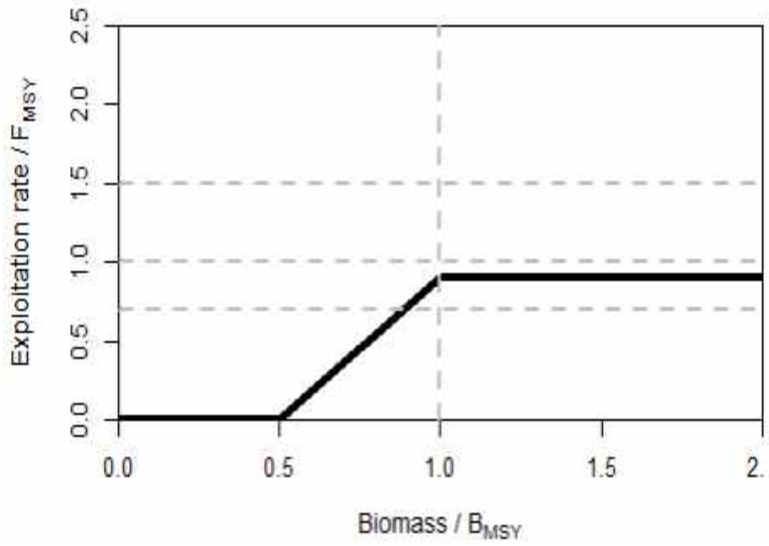
HCR 1 IATTC-like



HCR 2 Moderate



HCR 3 Conservative

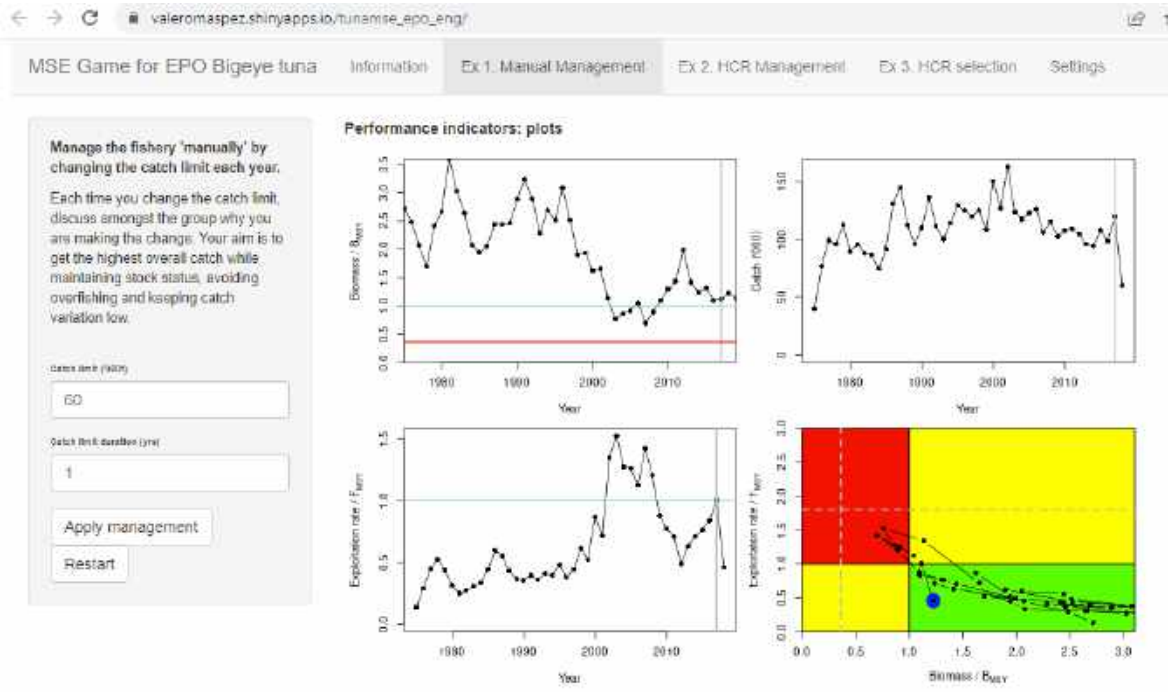


Harvest Control Rules for BET MSE

- Applied on a 3-year cycle
- Effort controls (days of closure) for surface fleets, Catch limits for longline fleets
- Data inputs for HCR:
  - Empirical HCR: standardized Japanese longline index of abundance
  - Model-based HCR: standardized Japanese longline index of abundance and total catches

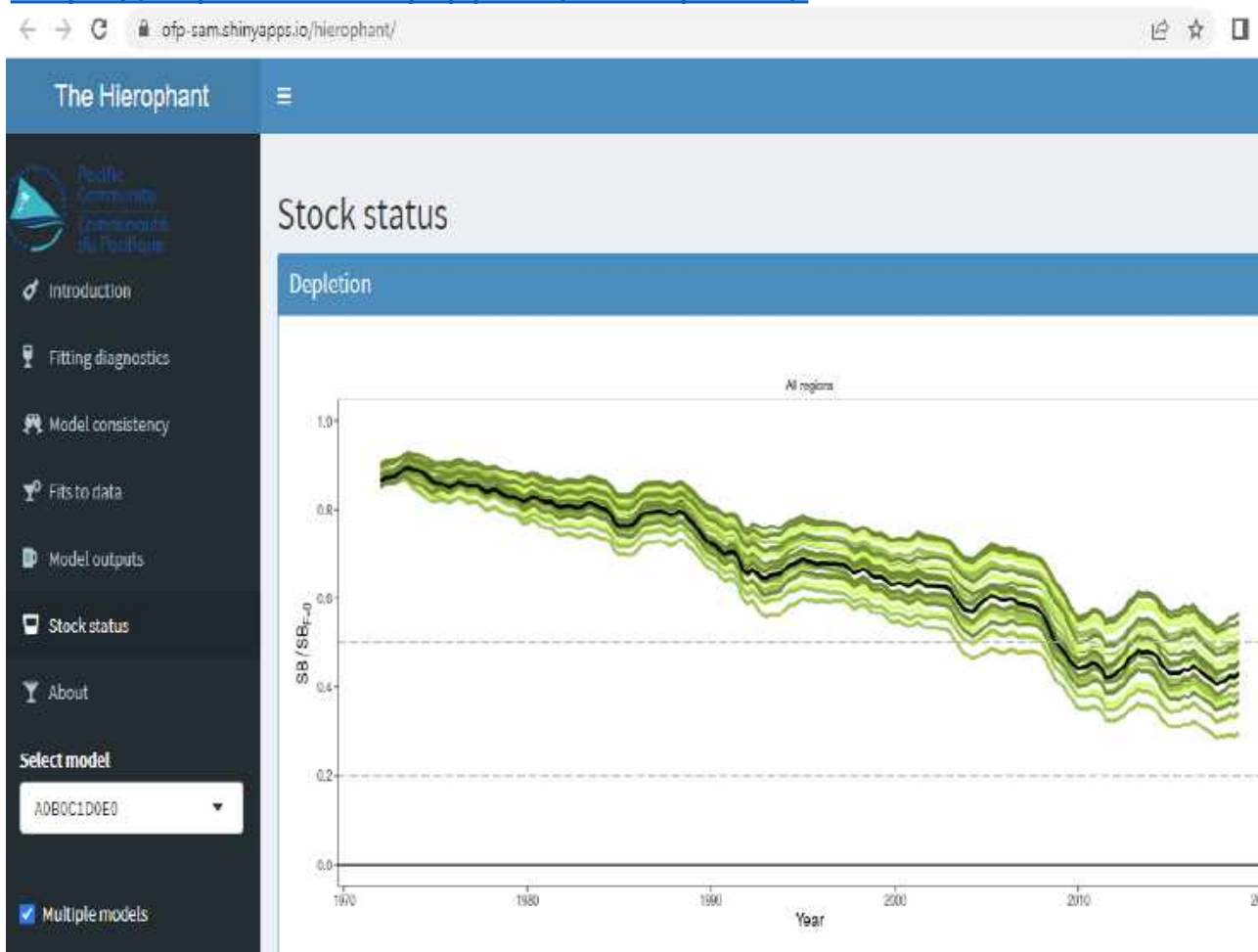
Expand current BET Toy MSE app to illustrate OMs and MSE results

https://valeromaspez.shinyapps.io/TunaMSE_EPO_ENG/



Summary Model

https://ofp-sam.shinyapps.io/hierophant/



Timeline of current project and future steps

MSE tropical tunas – *EEO atunes tropicales*

DOCUMENT SAC-13-INF-C link

GREEN: COMPLETED; BLUE: FUNDED; RED: UNFUNDED, Text ~~struck through~~ indicates completed or terminated projects

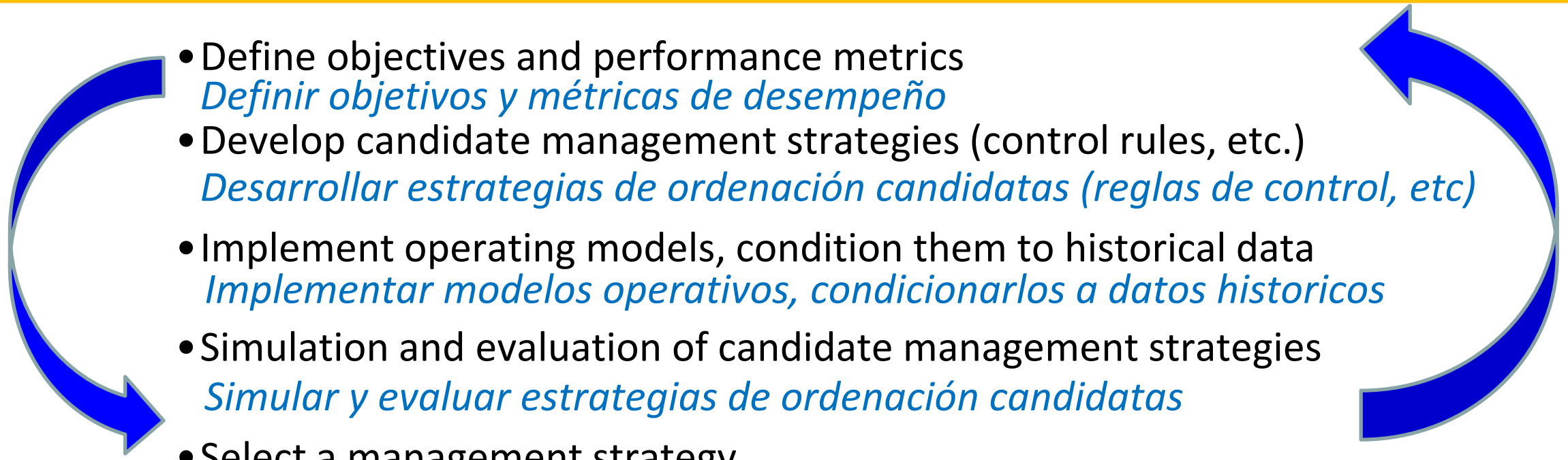
SSP ref.	Target/Project	2018		2019		2020		2021		2022		2023		2024	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2
	1. SUSTAINABLE FISHERIES														
	Goal I: Test harvest strategies using Management Strategy Evaluation (MSE)														
I.1.	Conduct a comprehensive MSE for bigeye tuna and plan MSEs for the other tropical tuna species														
I.1.a	1. Stakeholder and technical MSE workshops														
	a. Technical meetings to agree on overall/revised MSE Plan by IATTC staff and collaborators														
	b. Stakeholder workshops on training and communication on MSE development and results														
	2. Technical development of MSE, HCR, MP, outputs														
	~~a. Improve the bigeye assessment for use as spatial OM~~														
	~~b. Run preliminary simulations with spatial OM~~														
	a. Run preliminary MSE based on initial input from managers and stakeholders														
	b. Run final MSE based on revised input from managers and stakeholders														
	c. Present evaluated HCR/MP to Commission, plan work for other tropical tunas														

Transition of MSE work to other tropical species (YFT, SKJ) after 2014 to be outlined in the new IATTC Strategic Science Plan (planned in 2023)

Transición a EEO de otros atunes tropicales (YFT, SKJ) en 2014 detallado en el nuevo Plan Estratégico Científico de la CIAT (planeado en 2013)

Funds?
¿Fondos?

Steps in Management Strategy Evaluation
Pasos en Evaluación de Estrategias de Ordenación



- Define objectives and performance metrics
  Definir objetivos y métricas de desempeño
- Develop candidate management strategies (control rules, etc.)
  Desarrollar estrategias de ordenación candidatas (reglas de control, etc)
- Implement operating models, condition them to historical data
  Implementar modelos operativos, condicionarlos a datos historicos
- Simulation and evaluation of candidate management strategies
  Simular y evaluar estrategias de ordenación candidatas
- Select a management strategy
  Seleccionar una estrategia de ordenación
- Consider implementing the evaluated management strategy
  Considerar implementar la estrategia de ordenación evaluada

PROCESS NOT LINEAR!!! / *Proceso no lineal!!!*

ITERATIVE!!! / *Iterativo!!!*

Questions? *¿Preguntas?*