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ITEM 5. FEEDBACK FROM THE SMALL WORKING GROUP ON MSE PRESENTATION

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CHRONICLES OF THE MPD AND TCMP

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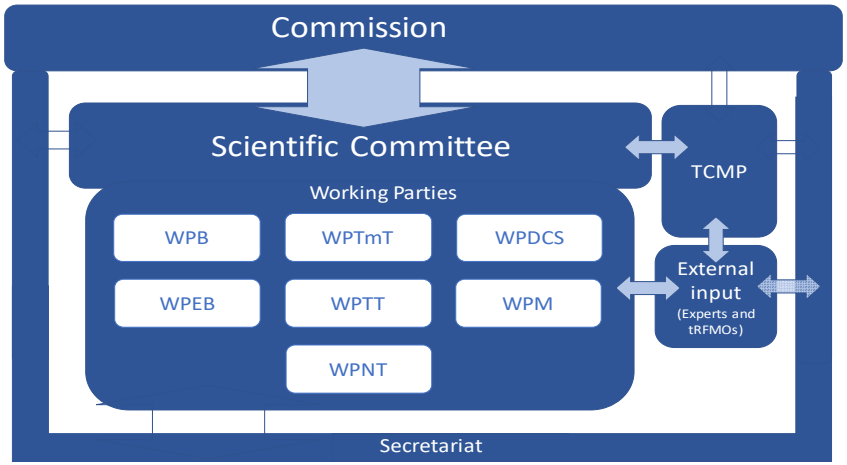
Resolution 14/03 On enhancing the dialogue between fisheries scientists and managers (superseded by **16/09**)
Management Procedure Dialogue (MPD)

MPD01 (2014) Colombo, Sri Lanka
MPD02 (2015) Busan, Rep. of Korea
MPD03 (2016) La Réunion, France

Resolution 16/09 On establishing a Technical Committee on Management Procedures (TCMP)
The TCMP has been providing a formal communication arena between scientists and decision makers to discuss technical and practical matters on the development of MPs under the framework of MSE

TCMP01 (2017) Yogyakarta, Indonesia
TCMP02 (2018) Bangkok, Thailand
TCMP03 (2019) Hyderabad, India
TCMP04 (2021) By videoconference
TCMP05 (2022) Eden Island, Seychelles (hybrid)
TCMP06 (2023) Mauritius (hybrid)
TCMP07 (2024) By videoconference
TCMP08 (2024) Bangkok, Thailand



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FROM 2023 COMMISSION REPORT

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11. Report of the Technical Committee on Management Procedures

76. The Commission **NOTED** the report of the 6th meeting of the Technical Committee on Management Procedures (TCMP) (IOTC-2023-TCMP06-R) and **ENDORSED** the following TCMP recommendation:

- The TCMP **NOTED** the recommendation by the SC that it is advisable to have focused dialogue with managers on those MSEs which are more advanced such as that for SKJ and SWO. The TCMP therefore **RECOMMENDED** that a virtual TCMP is convened early in 2024 with a special focus on the MSEs for SKJ and SWO, and that it be held back-to-back with the WPM(MSE) meeting.

6 STATUS OF THE MANAGEMENT STRATEGY EVALUATION/OPERATING MODELS AND ACTIONS NEEDED FOR ADOPTION (Developers)

6.1 Skipjack tuna (Charlie Edwards)
6.2 Swordfish (Thomas Brunel)

7 PREPERATION FOR THE 8TH SESSION OF THE TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (Co-Chairs)

7.1 Advice on suitability for adoption of MPs
7.1.1 Skipjack
7.1.2 Swordfish

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FROM 2023 COMMISSION REPORT

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11. Report of the Technical Committee on Management Procedures

77. The Commission **SUPPORTED** the work conducted by the TCMP and its role in providing science-based advice for management. However, the Commission **AGREED** that the dialogue in the TCMP has become too technical and has limited the involvement of managers in recent years, as most of the discussions take place among the technical experts.

79. The Commission **REQUESTED** the MSE developers to communicate the results of their analyses in a less technical manner and **ENDORSED** the creation of a small working group to discuss and agree on ways to improve communication between the scientists and the managers. This could include modifying the existing templates for presentation of MSE outputs to increase understanding and better meet the needs of the managers.

5 FEEDBACK FROM THE SMALL WORKING GROUP ON MSE PRESENTATION (SC Chair)

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SMALL GROUP DISCUSSION ON FEBRUARY 1ST, 2024

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Participants: Qayiso Mketsu, Adam Ziyad, Ann Preece, Hilario Murua, Shana Miller, Paul de Bruyn (Jess Keedy, Gorka Merino)

The discussions focused on streamlining presentations, improving engagement, and finding effective ways to enhance managers' understanding of MSE processes.

- Participants discussed how to develop presentations & documents on species MSE outcomes to facilitate communication and decision-making
  - **Simplifying the presentations** and using familiar terms for managers
  - Adopting a **standardized format** for **written summaries with clear decision points**
  - A specific **table** format for comparing MPs
  - Main results in main body of document, **and detailed figures** are attached as **appendices** (for TCMP08)

- The participants also discussed needs to
  - clarify the importance of MSE by explaining the **advantages of MP** in addition to assessment
  - clarify the **uncertainty** of future projections when explaining the results
  - explain the **difference** between the **most recent TAC** in the simulation and **the TAC derived** immediately after the MP is conducted

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SMALL GROUP DISCUSSION ON FEBRUARY 1ST, 2024

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- The participants exchanges ideas on **capacity-building sessions;**
  - Timing: concerns that these sessions taking place in the TCMP meetings **immediately prior to the Commission** meetings was **not optimal** as managers are often distracted by upcoming Commission issues and can't focus on the capacity building information.
  - The idea of a **hands-on demonstration** to make discussions more (for future meetings)
  - Alternative approaches were suggested such as
    - ✓ informal ambassador meetings/workshops around existing meetings
    - ✓ leveraging online tools for capacity building
  - **IOTC resources** (https://edu.iotc.org/)
  - The participants agreed to discuss these suggestions further in the TCMP meeting

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ITEM 6. STATUS OF THE MSE/OMS AND ACTIONS NEEDED FOR ADOPTION

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MSE IN NUTSHELL

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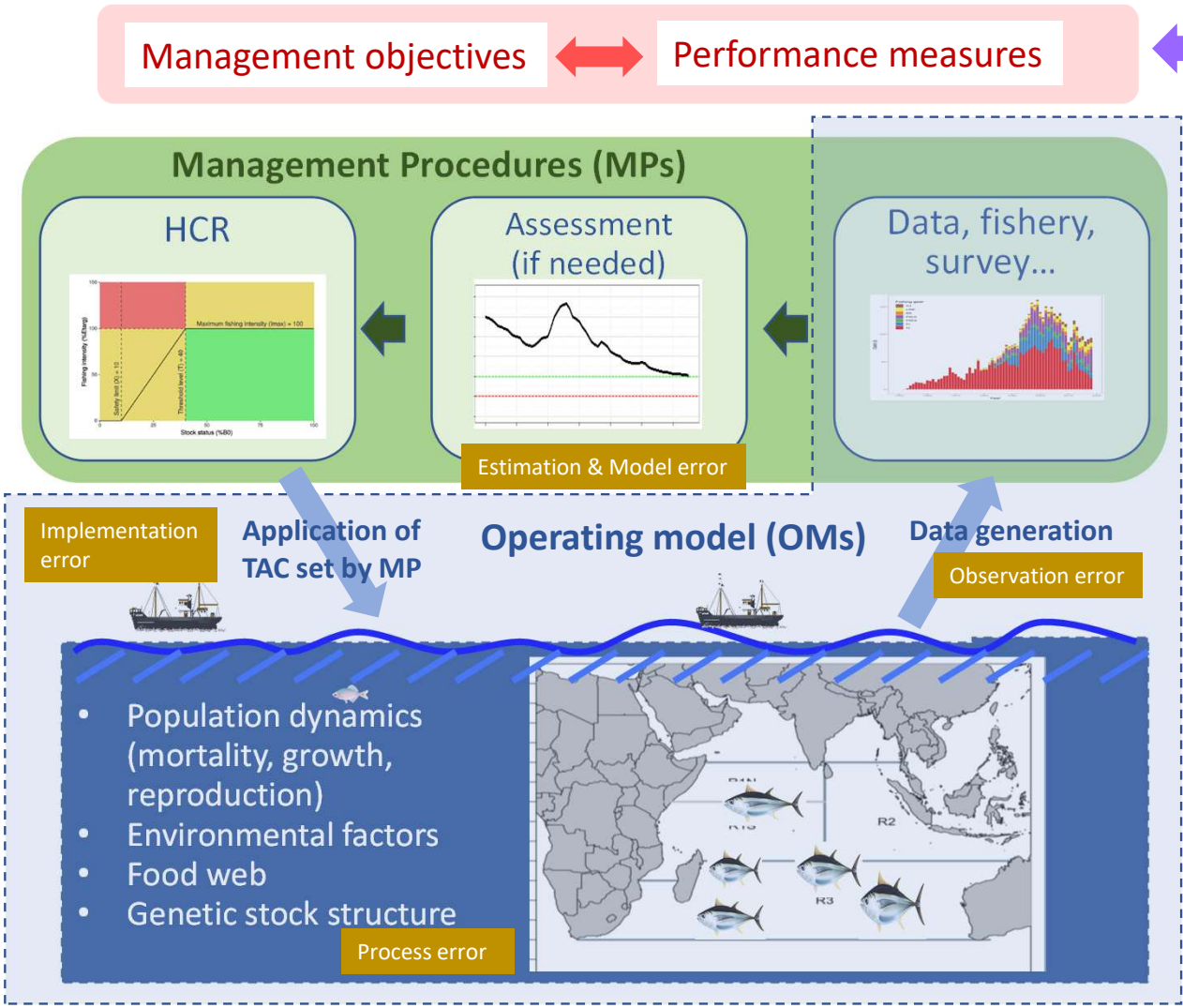
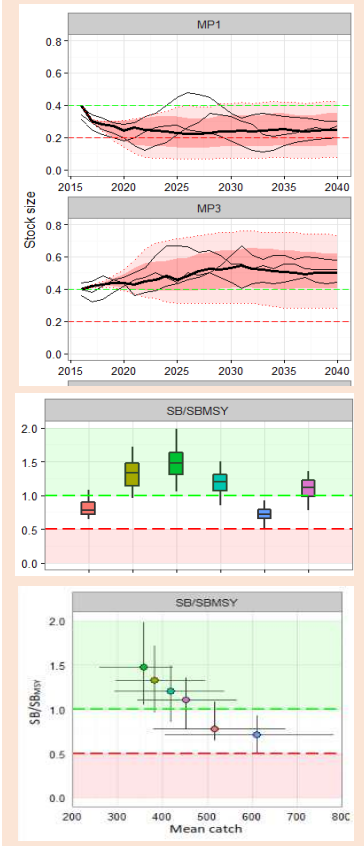
MSE Process

1. Identification of **Management objectives** and **performance indicators**
2. Development of **Management Procedures (MPs)**
3. Development of **Operating Models (OMs)**
4. **Simulation testing** of MPs with the OMs
5. **Selection of an MP** based on simulation performance
6. **Implementation of the MP**





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HARVEST CONTROL RULE FOR SKIPJACK TUNA

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Resolution 16/02 On Harvest Control Rules for skipjack tuna in the IOTC area of competence (Superseded by **21/03**)

Reference Points

3. Consistent with paragraph 2 of Resolution 15/10, the biomass limit reference point, B_{lim}, shall be 20% of unfished spawning biomass[5] (i.e. $0.2B_0$).

4. Consistent with paragraph 3 of Resolution 15/10, the biomass target reference point, B_{targ}, shall be 40% of unfished spawning biomass (i.e. $0.4B_0$).

5. The HCR described in paragraphs 6–12 seeks to maintain the skipjack tuna stock biomass at, or above, the target reference point while avoiding the limit reference point.

Harvest Control Rule (HCR)

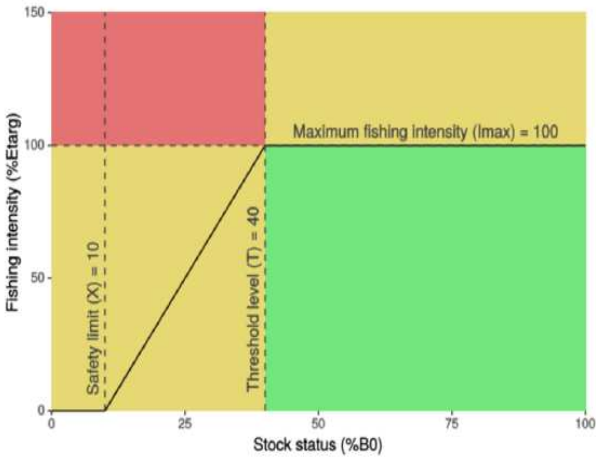
6. The skipjack tuna stock assessment shall be conducted every three (3) years, with the next stock assessment to occur in 2023. Estimates of 7(a–c) shall be taken from a model-based stock assessment that has been reviewed by the Working Party on Tropical Tunas and endorsed by the Scientific Committee via its advice to the Commission.

7. The skipjack tuna HCR shall recommend a total annual catch limit using the following three (3) values estimated from each skipjack stock assessment. For each value, the reported median from the reference case adopted by the Scientific Committee for advising the Commission shall be used.

   a) The estimate of current spawning stock biomass (B_{curr});

   b) The estimate of the unfished spawning stock biomass (B_0);

   c) The estimate of the equilibrium exploitation rate (E_{targ}) associated with sustaining the stock at B_{targ}.



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HARVEST CONTROL RULE FOR SKIPJACK TUNA

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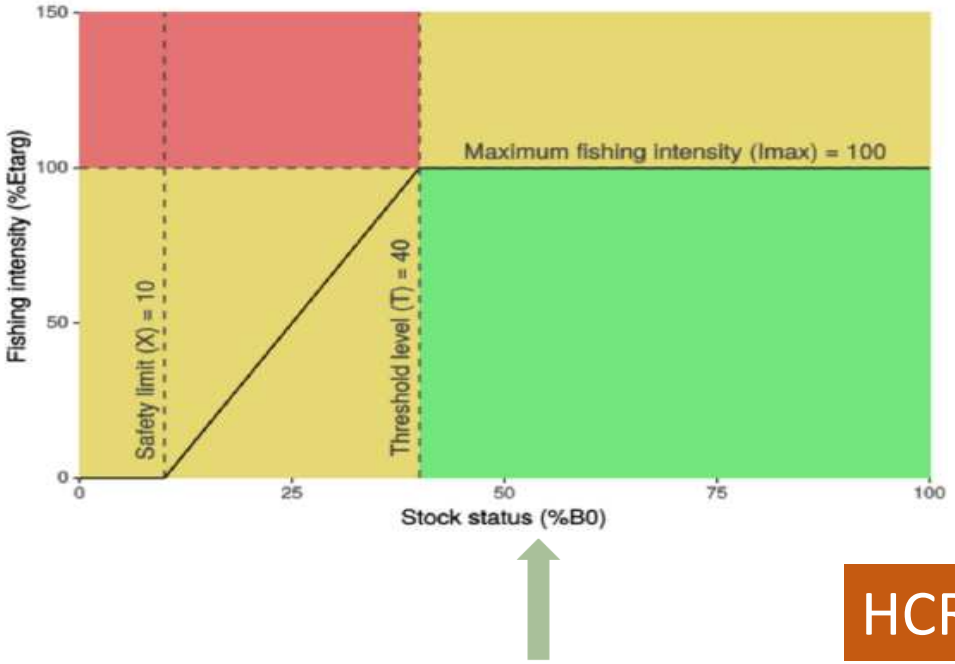
b) The estimate of the unfished spawning stock biomass (B_0);

c) The estimate of the equilibrium exploitation rate (E_{targ}) associated with sustaining the stock at B_{targ}.



From stock assessment (external to HCR)

SB_{2022} = 1,143 (1000t)

SB0 = 2,177 (1000t)

SB_{2022}/SB0 = 0.53 > 0.40

Etarg (Exploitation rate for 40%SB0) = 0.55

HCR

Catch limit = Etarg * SB_{2022}

= 0.55 * 1,143 = 629 (1000t)

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HARVEST CONTROL RULE FOR SKIPJACK TUNA

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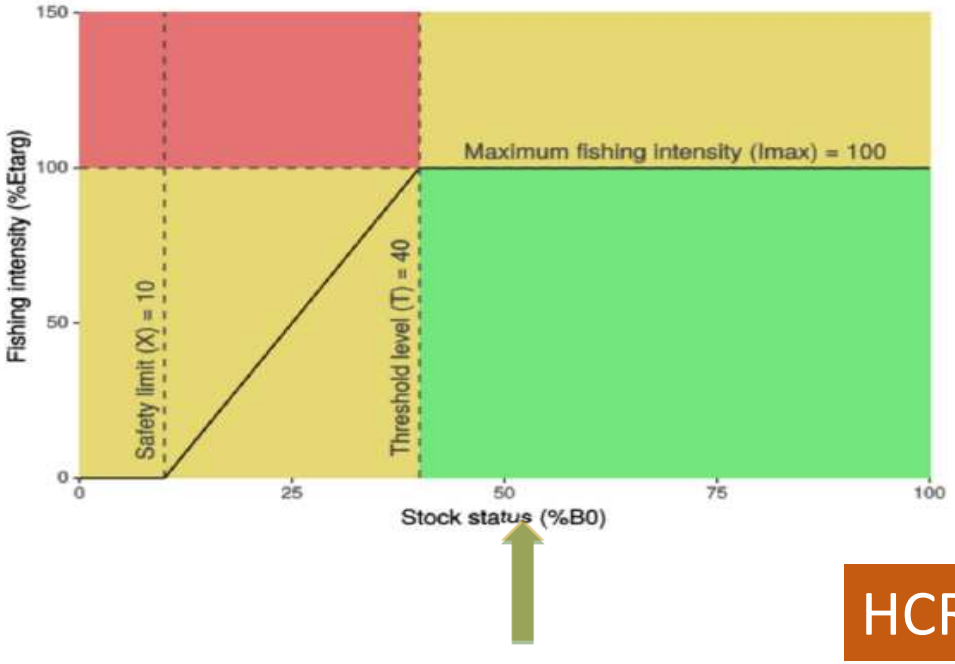
Resolution 16/02 On Harvest Control Rules for skipjack tuna in the IOTC area of competence (Superseded by **21/03**)

a) The estimate of current spawning stock biomass (B_{curr});

b) The estimate of the unfished spawning stock biomass (B_0);

c) The estimate of the equilibrium exploitation rate (E_{targ}) associated with sustaining the stock at B_{targ}.

Remark: This is a fiction !!



SB_{20XX} = 500 (1000t)

SB0 = 2,000 (1000t)

SB_{20XX}/SB0 = 0. 25 < 0.40

Etarg (Exploitation rate for 40%SB0) = 0.55

HCR

Catch limit = I * Etarg * SB_{20XX}

= 0.5 * 0.55 * 500 = 138 (1000t)

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MANAGEMENT PROCEDURE FOR BIGEYE TUNA

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Resolution 22/03 On a Management Procedure for bigeye tuna in the IOTC area of competence

Management procedure

2. The adopted management procedure for bigeye tuna known as MP1 Harvest is described in Annex I (MP).

3. Consistent with the adopted management objectives of the Commission, the management procedure is designed to achieve:

   a) a 60% probability that the bigeye tuna spawning stock biomass achieves the target reference point of SB_{MSY}[1] by 2034-2038;

   b) the bigeye tuna spawning stock biomass avoids breaching the interim limit reference point specified in Resolution 15/10 with a high probability;

   and operates with the following constraint:

   c) the maximum increase or decrease in the TAC shall be 15% relative to the previous TAC.

$$TAC_{new} = B_y(1 - exp(-F_{mult} \times HCR_{mult} \times F_{MSY\ ratio}))$$

Total Allowable Catch setting

4. The Scientific Committee shall run the MP and advise the Commission of the outcome, including a recommended TAC and any advice on exceptional circumstances in accordance with the Commission endorsed Guidelines for the Provisions of Exceptional Circumstances for IOTC MPs as documented in Appendix 6a of IOTC-2021-SC24-R.

5. The Commission shall adopt the TAC based on the outcome of the MP, unless the Scientific Committee identifies exceptional circumstances that require consideration of alternate management actions to be taken by the Commission.

TAC allocation

9. Allocation of the TAC among CPCs will take place according to a process agreed external to this measure.

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RUNNING THE BIGEYE TUNA MP FOR 2022

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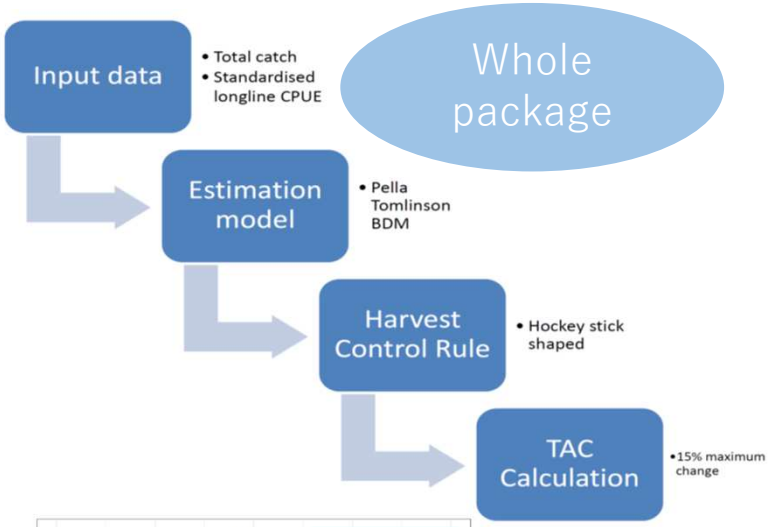

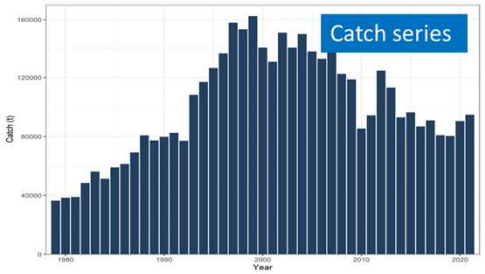

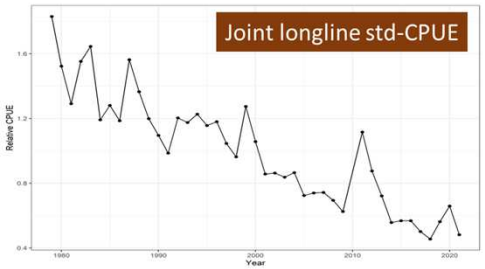

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RUNNING THE BIGEYE TUNA MP FOR 2022

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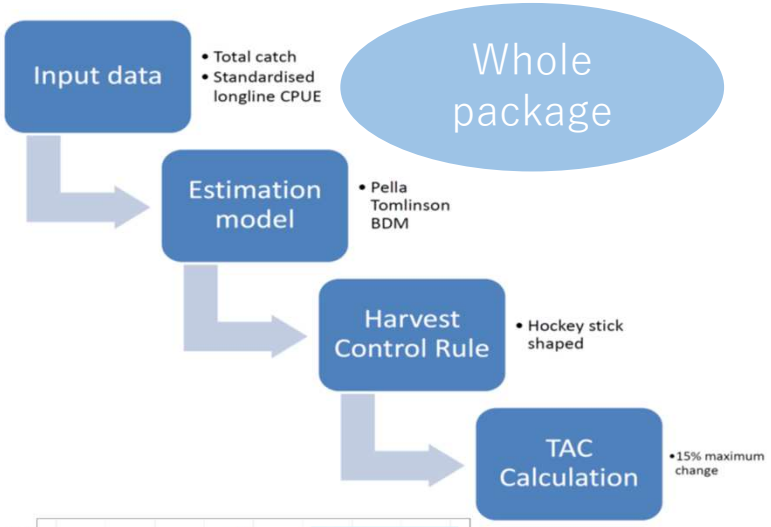
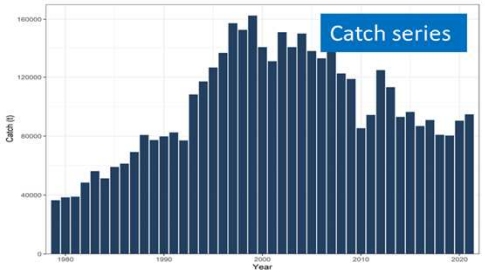
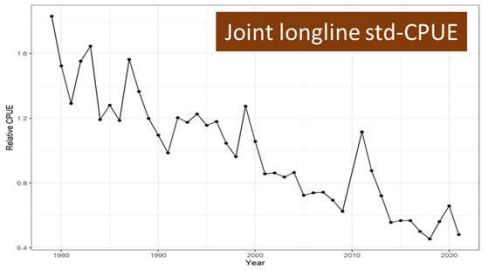
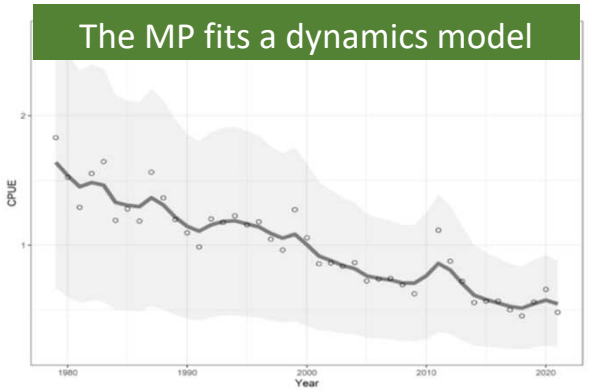






The MP fits a dynamics model



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RUNNING THE BIGEYE TUNA MP FOR 2022

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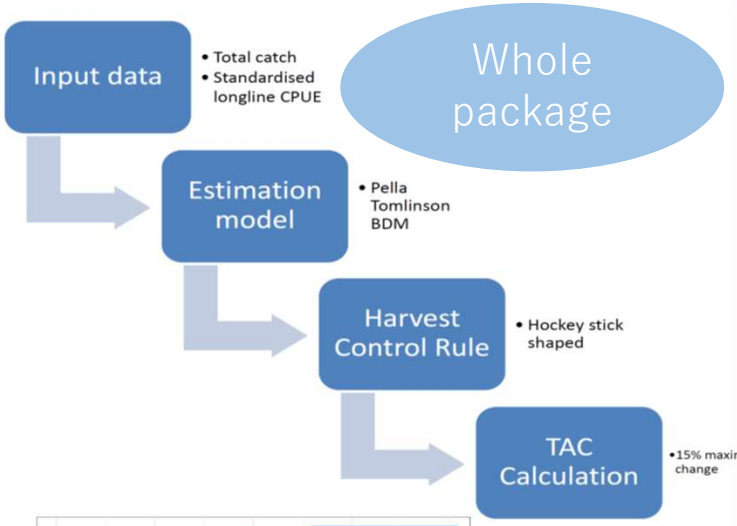
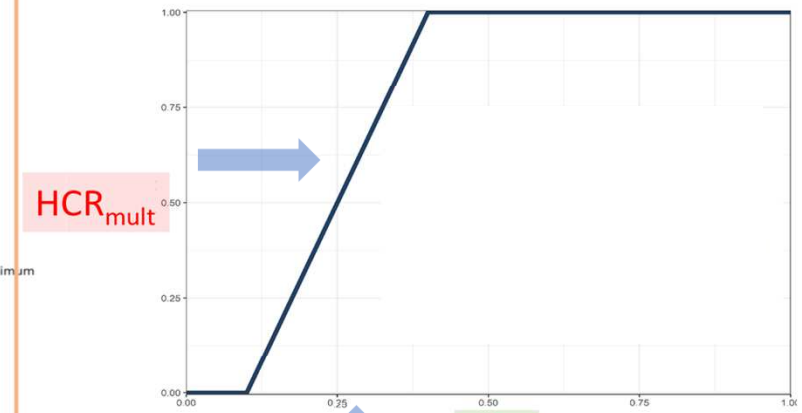


- Hockey-stick shaped Harvest Control Rule (HCR)

$$TAC_{new} = B_y(1 - exp(-F_{mult} \times HCR_{mult} \times F_{MSY\ ratio}))$$



(fixed tuning para) F_{mult} = 3.178

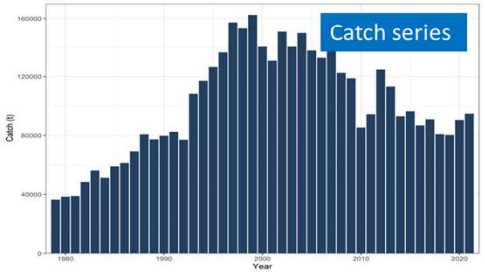
(from estimation model)

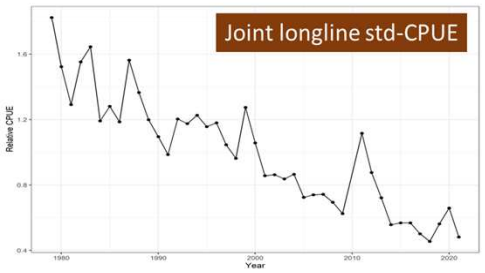
B_y = 587,081 (t)

B_y /K = 0.284

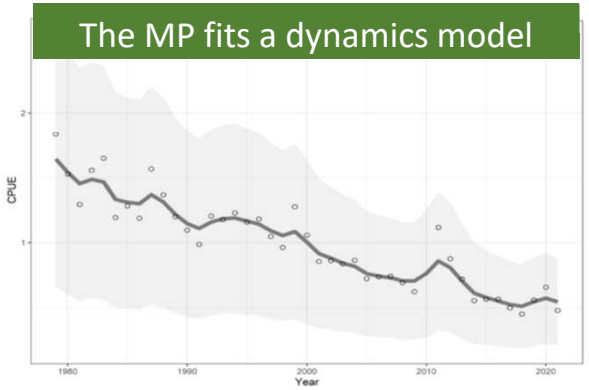
F_{MSY} ratio = 0.05446528

(from HCR) HCR_{mult} = 0.611719





The MP fits a dynamics model



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RUNNING THE BIGEYE TUNA MP FOR 2022

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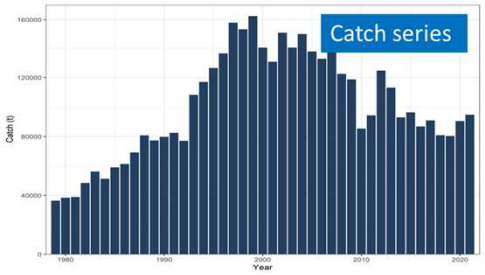
Input data
- Total catch
- Standardised longline CPUE

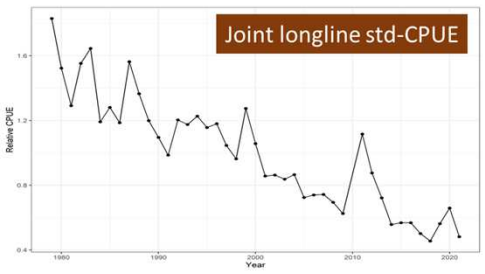
Whole package

Estimation model
- Pella Tomlinson BDM

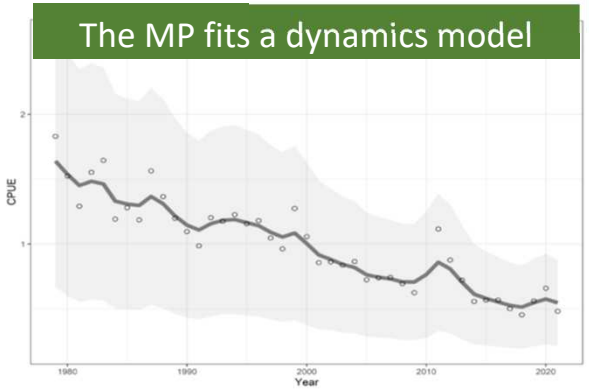
Harvest Control Rule
- Hockey stick shaped

TAC Calculation
- 15% maximum change



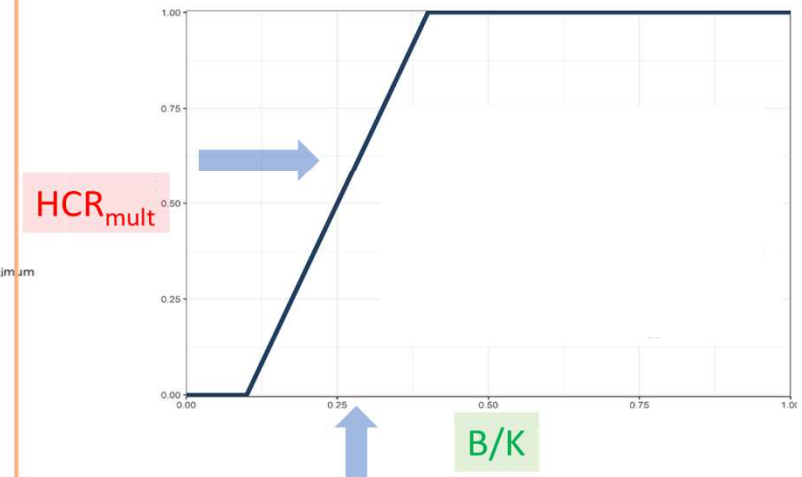


The MP fits a dynamics model



- Hockey-stick shaped Harvest Control Rule (HCR)

$$TAC_{new} = B_y(1 - exp(-F_{mult} \times HCR_{mult} \times F_{MSY\ ratio}))$$



(fixed tuning para) F_{mult} = 3.178

(from estimation model)

B_y = 587,081 (t)

B_y /K = 0.284

F_{MSY} *ratio* = 0.05446528

(from HCR) HCR_{mult} = 0.611719

TAC_{new} = 68,404 t

(>15% lower than 2021 catch of 94,803 t)

Recommended TAC (endorsed by SC)

= 80,583 t (15% below 2021 catch)

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STOCK ASSESSMENT

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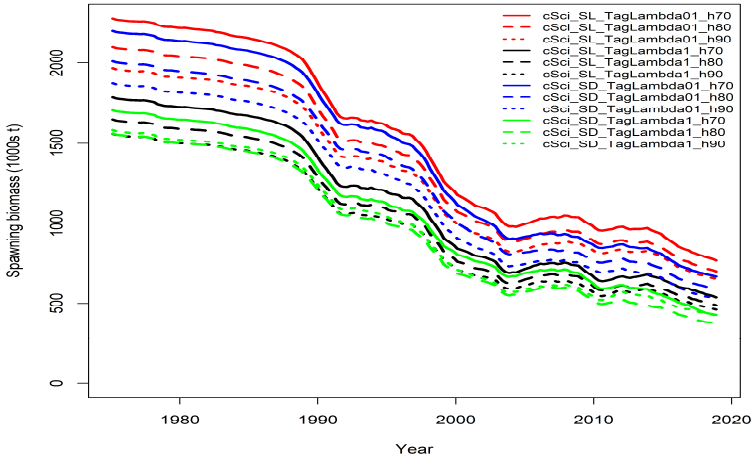

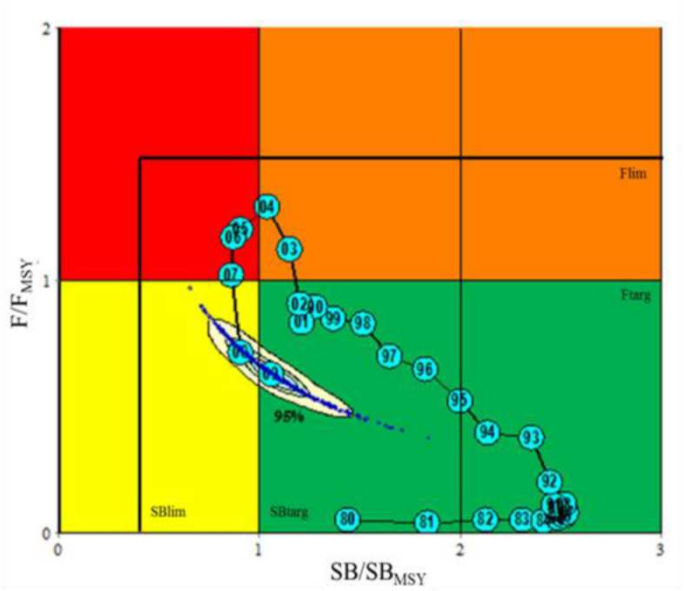

EXAMPLE 2: Species: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections (average catch level from YYYY–YYYY (xx,xxx t), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe		Alternative catch projections (relative to the average catch level from YYYY–YYYY) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)								
		60% (catch t)	70% (catch t)	80% (catch t)	90% (catch t)	100% (catch t)	110% (catch t)	120% (catch t)	130% (catch t)	140% (catch t)
Short time frame (3rys)	$B_{2016} < B_{MSY}$	9	13	19	28	40	53	65	82	86
	$F_{2016} > F_{MSY}$	3	6	30	56	81	91	98	99	100
Mid time frame (10yrs)	$B_{2023} < B_{MSY}$	0	0	1	3	14	41	87	100	100
	$F_{2023} > F_{MSY}$	0	0	5	67	92	98	99	100	100

Reference point and projection timeframe	Alternative catch projections (relative to the average catch level from YYYY–YYYY) and probability (%) of violating MSY-based limit reference points ($B_{lim} = 0.4\ B_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)								
	60% (catch t)	70% (catch t)	80% (catch t)	90% (catch t)	100% (catch t)	110% (catch t)	120% (catch t)	130% (catch t)	140% (catch t)
$B_{2016} < B_{Lim}$	4	6	8	14	20	23	40	45	65
$F_{2016} > F_{Lim}$	3	6	15	15	20	33	45	67	100
$B_{2023} < B_{Lim}$	0	0	0	6	24	26	49	74	100
$F_{2023} > F_{Lim}$	0	0	0	10	22	45	67	96	100

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"Projection based on stock assessment" & "Projection in MSE"

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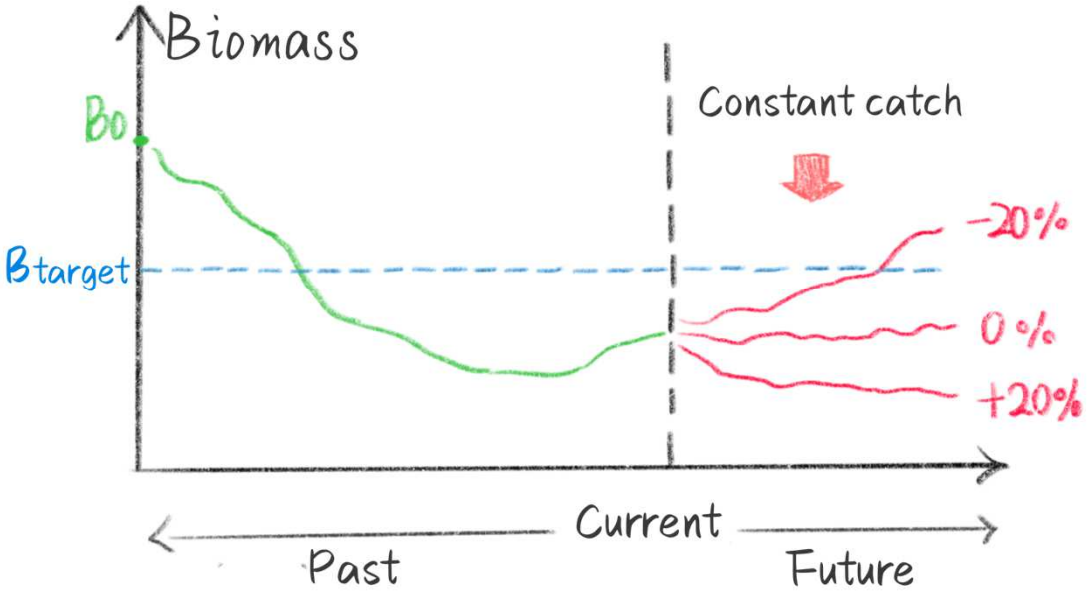
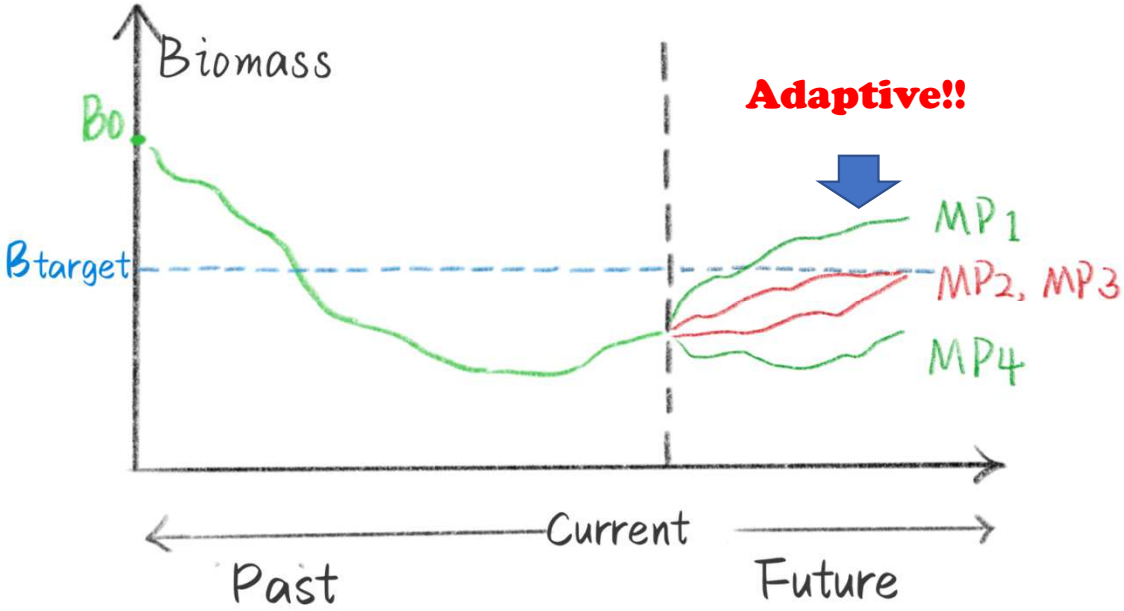
"Management strategy evaluation is not the same as conducting projections from a stock assessment, although a stock assessment may form the basis for the operating model(s) which are core to an MSE" (Punt et al. 2016)

Simple projection on stock assessment:
Based on a **predetermined** but **constant** catch over time with a certain level of catch reduction/enlargement



Projection in MSE:
Based on a **predetermined rule** with a **feedback mechanism** to control the catch



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OVERVIEW OF MSE

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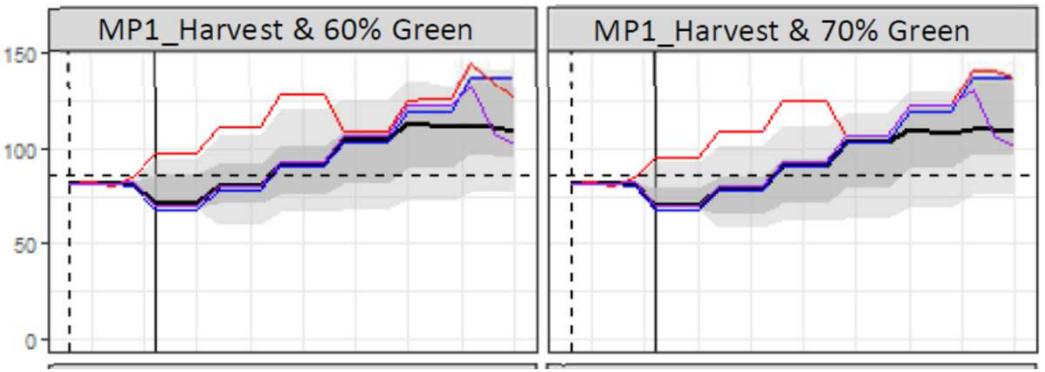
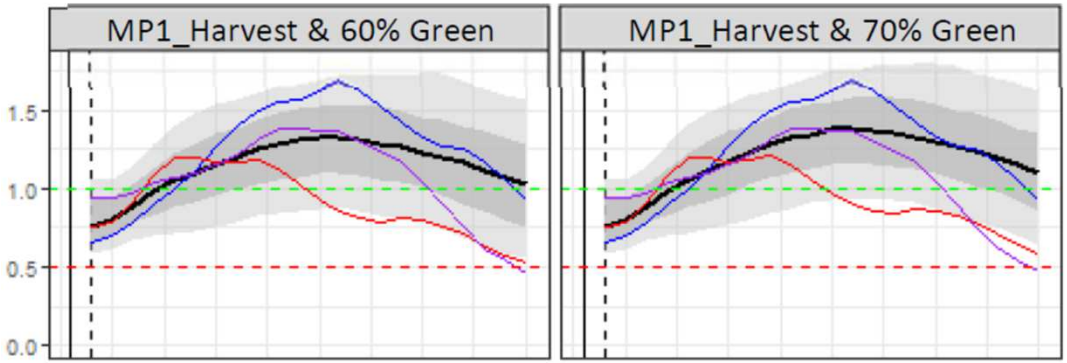
Merits of MSE

- **Comprehensiveness**, **Transparency** and **Dialogue**
- Possible to understand the **expected behavior of "MPs"** if implementing them in fishery
- Information is available in advance for some **likely trajectories** and their ranges for biomass, catch, etc. after implementing an MP
- Consider in advance **uncertainty** in data, model, estimation, projection, implementation etc.
- Ensure a certain level of **robustness** of management performance to uncertainty

Catch



SSB/SSBmsy



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MSE IN NUTSHELL

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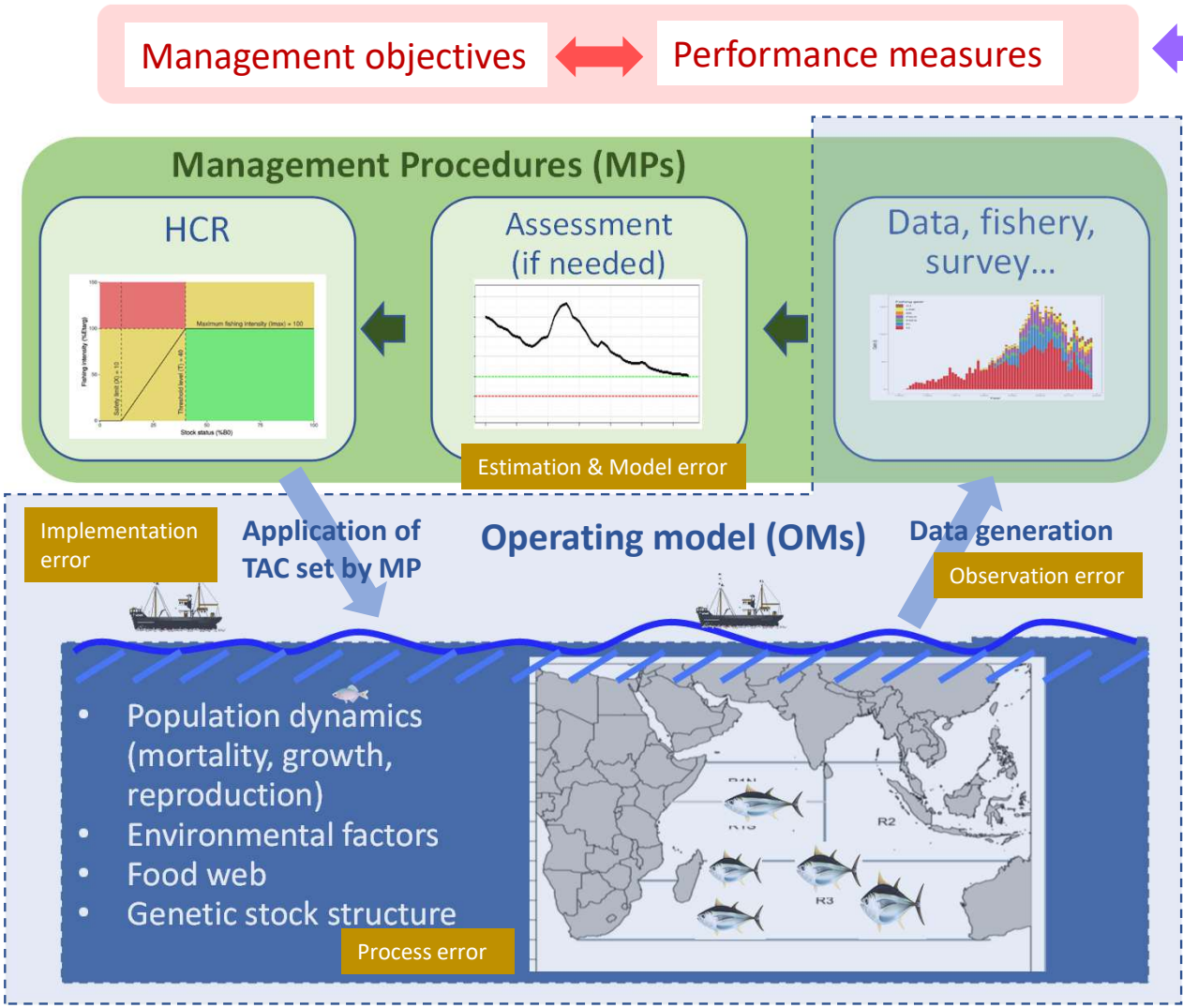
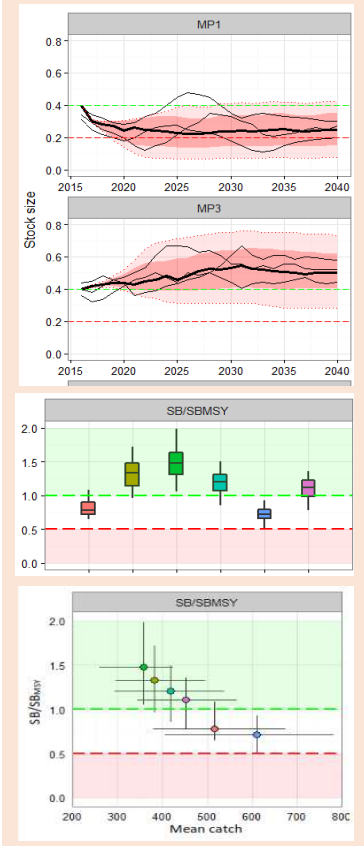
MSE Process

1. Identification of **Management objectives** and **performance indicators**
2. Development of **Management Procedures (MPs)**
3. Development of **Operating Models (OMs)**
4. **Simulation testing** of MPs with the OMs
5. **Selection of an MP** based on simulation performance
6. **Implementation of the MP**





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KEY WORDS AND CONCEPTS

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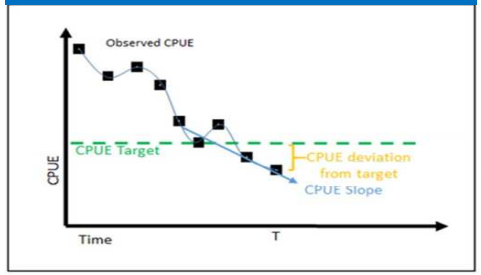
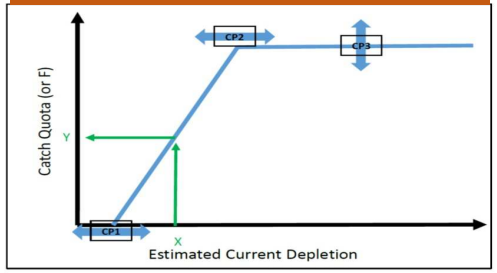
- **Type of MPs**
  - Data-based (CPUE-based)
  - Model-based (Assessment and Harvest Control Rule)

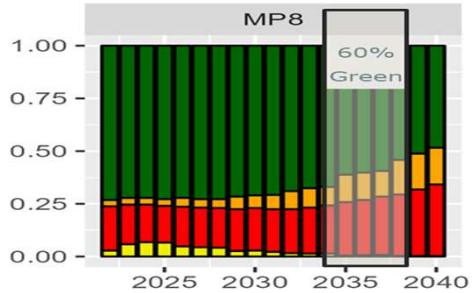
Data-based MP



Model-based MP



- **Tuning criteria**
  - Setting options associated with the management goals
  - Normal practice with the Kobe green quadrant probability (50, 60 and 70%)



- **Operating models**
  - To play roles of **"virtual population dynamics"** & **"virtual fishery"** in simulation
  - Simulation mechanism to evaluate impact of fishery
  - Assumed population dynamics (mostly based on assessment & range of uncertainties)
  - Virtual fisheries and virtual data (e.g. catch and CPUE) in future

- **Other elements**
  - Constraints (maximum change in TAC): symmetric or asymmetric (upwards/downward)
  - Implementation lag: 2-3 yrs
  - Robustness scenarios
  - Exceptional circumstances

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ACHIEVEMENT AND PROGRESS ON MSE IN THE IOTC

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	Yellowfin	Bigeye	Skipjack		Swordfish	Albacore
Current status	2021	2022	2023		2023	2022
Existing HCR/MP		22/03 (MP) 23/04 (Catch limit)	16/02 & 21/02 (HCR)			
Tuning criterion	Prob(SB_{20XX} >= SBmsy) = 0.5 for 20XX=2029, 2034	Prob(Kobe Green) ~~= 50%,~~ 60%, 70%		Prob(B<B40% & E<E40%) ~~=~~50%, 60%, 70%	Prob(Kobe Green) ~~= 50%,~~ 60%, 70%	Prob(Kobe Green) ~~=~~ 50%, 60%, 70%
MP type		~~• Data-based~~ • Model-based (MP1-Harvest MP2-Target)	HCR (Inputs from SS3 assessment)	• Data-based ~~• Model-based~~	• Data-based • Model-based	• Data-based • Model-based
Constraints etc.		15% maximum change	30% max change Cmax=900,000 (t)	Several options	Several options	
Progress in MSE (EC: exceptional circumstances)	Pending results of new assessment in 2024	Under peer-review process. Regular monitoring for EC		Near to final for selection of an MP	Near to final for selection of an MP	In Progress (new OM conditioning approach was agreed)