Overview of the WCPFC Harvest Strategy Approach

WCPFC SMD01 – 2nd Capacity Building Seminar

7th July 2022

Harvest Strategies

A formalised and pre-agreed framework for guiding decisions on the management of a fishery.

"Agreeing to the rules before playing the game"

designed to shift from short-term reactive decision making to a longer-term proactive approach to achieve defined management objectives.

Harvest Strategy Components

|	
Management Objectives	• What do you want from your fishery ?
Performance Indicators	• Quantifiable metrics that tell you how well you are achieving your objectives.
Management Procedures	• Pre-agreed rules to manage the fishery to achieve the objectives (includes the harvest control rule HCR)
Management Strategy Evaluation	• Simulation testing of management procedures to select the "best performing" • Allows to explore trade-offs
Monitoring Strategy	• Is the selected management procedure performing as expected? • How do we know if it's not working?

Management Procedures

A pre-agreed and tested procedure that determines the management action for a fishery given the status of the resource.

Three components

1. Data collection (log books, observer, tagging, catch statistics etc).
2. Estimation method to provide an estimate of stock status
3. Harvest control rule (HCR) to set fishing opportunities

All three components are agreed together as a package

Data collection

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Estimation method

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Harvest control rule

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Catch / effort limit
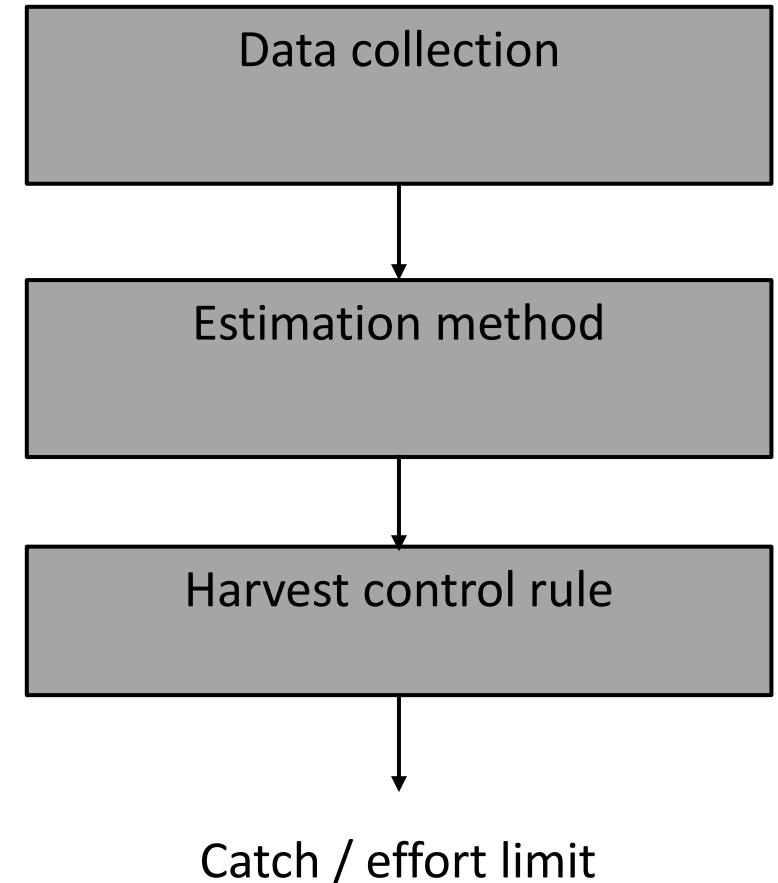
Question areas from 1ˢᵗ seminar

Management objectives

How do we make progress with harvest strategies if we don't have agreed management objectives?

Need to see results in order to make decisions

Management Procedures

How can a single model with fixed settings perform better than the most recent stock assessment?

Monitoring strategy

Using the latest stock assessment to monitor the framework
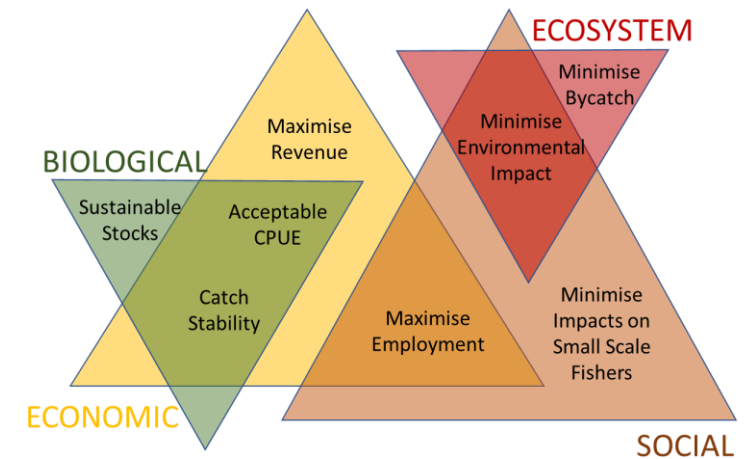
Management Objectives

How can we make progress with harvest strategies if we don't have agreed management objectives?

Performance indicators provide information on the relative performance of each MP and where trade-offs might occur.

An agreed TRP would implicitly make prioritisations and trade-offs between management objectives.
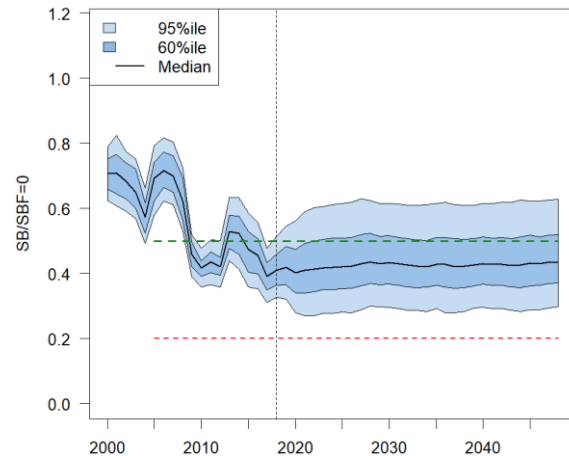
If a TRP was agreed there would be less focus on other performance indicators, although alternative MPs may still show trade-offs.

In the absence of an agreed TRP - results can inform TRP selection.
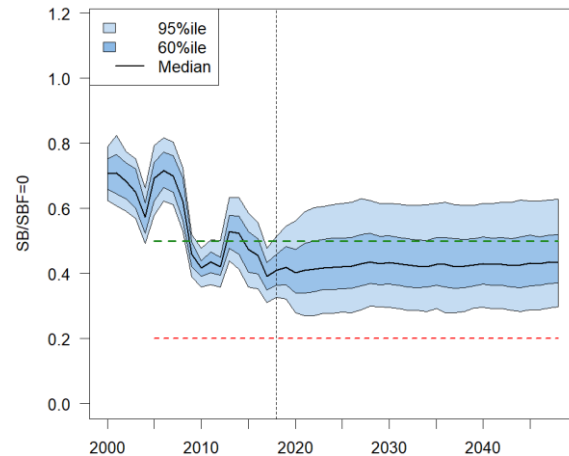
Management Procedure: Estimation Model

Why does the Management Procedure use a single model with fixed settings?
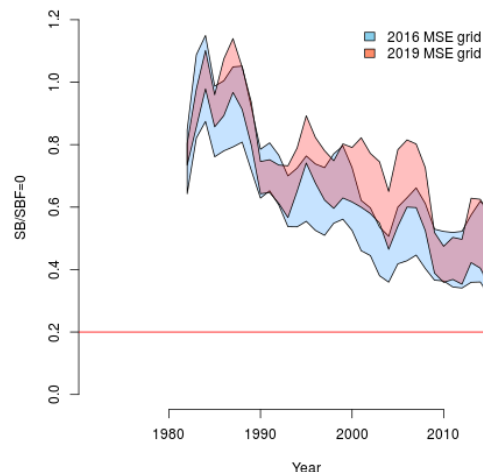

Current approach
- Run stock assessment (and projections) across a grid of alternative settings
- Management determined from the average of the results
- **The grid changes with each new assessment (settings, weightings, spatial scale)**
- **The average values will change with each new assessment.**

Management Procedure: Estimation Model

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Harvest Strategy approach
- Using a similar grid of model settings
- Test the management procedure across the grid of settings (operating models).
- Range of uncertainty should encapsulate new assessment results.
- Select the MP that performs best relative to the others.
- **Allows the management procedure to be tested beforehand.**
- **Maintains consistency and transparency in management.**

Monitoring Strategy

## What role does the most recent stock assessment play in the monitoring strategy?
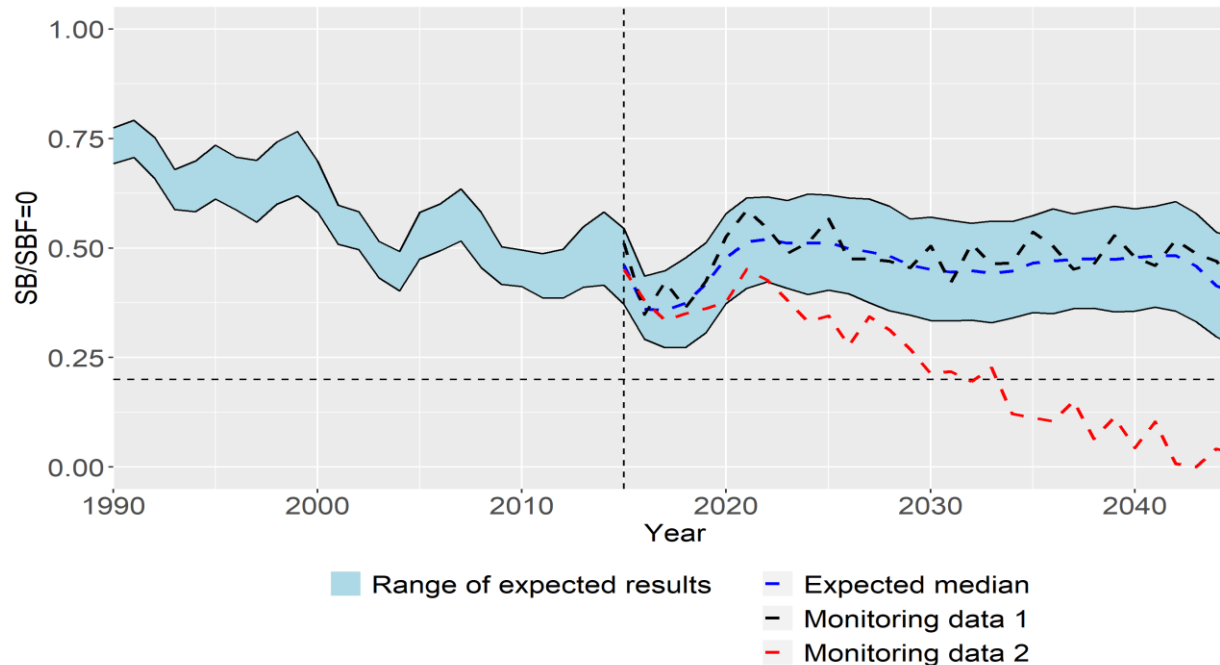
Stock assessment is one of the key pieces of information for the monitoring strategy

- Is the status of the stock within acceptable levels ?
- Is the range of uncertainty considered in the OM grid still appropriate ?
- Should any new ranges of uncertainty be considered ?
- Are we experiencing exceptional circumstances ?

- Ideally, new data should reduce the range of uncertainty rather than increase it.

Skipjack Modelling Framework

SC18 to agree the operating models for MSE
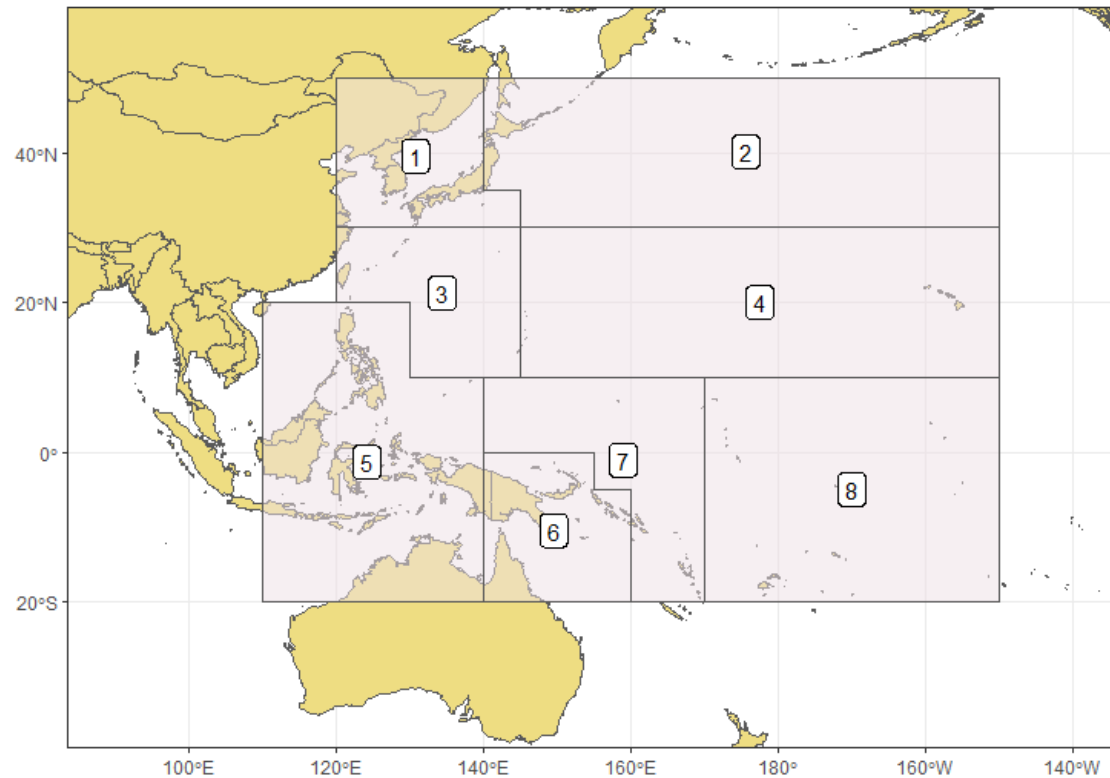
Operating Models

- Grid of alternative model assumptions
  - Growth
  - Recruitment
  - etc.

- Grid should cover the range of uncertainty in the fishery and the stock

- Must also consider uncertainty in future conditions
  - Catch and effort reporting
  - Recruitment
  - Effort creep
  - etc.

Skipjack MSE uncertainty grid

Axis	Levels	Options		
	Reference	0	1	2
Recruitment variability	2	1982-2018	2005-2018	
Catch & effort	1	20%		
Size composition	1	Estimated ESS		
Tag recaptures	1	Status quo		
Steepness	3	0.8	0.65	0.95
Mixing period	2	1 qtr	2 qtr	
Growth	2		Low	High
Movement	1	Estimated		
Hyper-stability in CPUE	2	0	-0.5	
Effort creep	2	0%	2%	

96 scenarios
10 iterations each scenario
960 evaluations for each HCR

Data collection

Model uncertainty

Management Procedures

For skipjack: the candidate
management procedures differ only
in the HCR
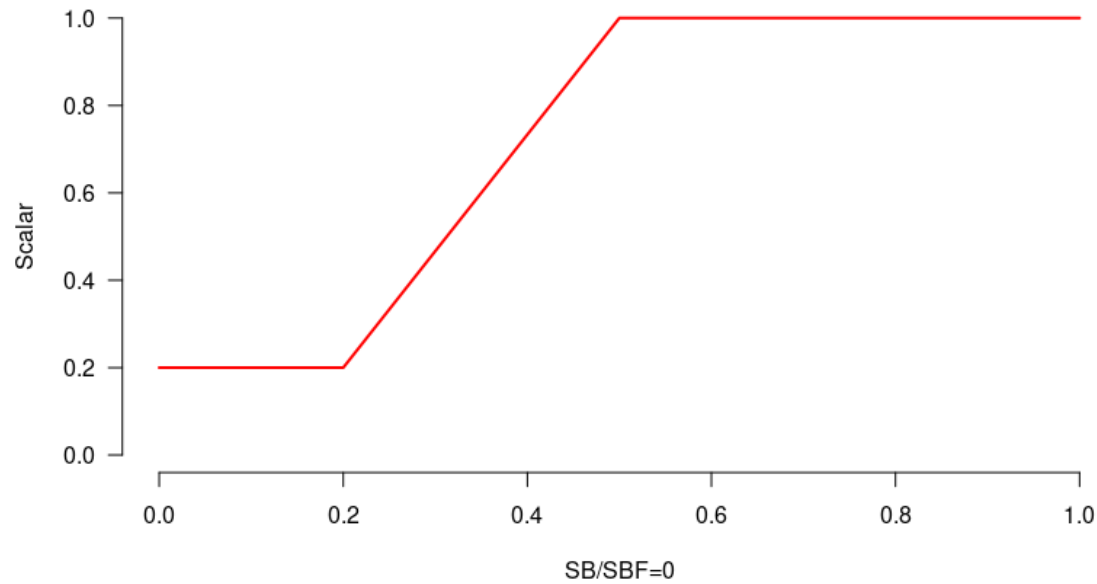
Basis of the management procedure:

- 3 year management period

- All fisheries subject to the management
  procedure (except archipelagic waters).

- Purse seine controlled by effort; other
  fisheries controlled by catch

- A scalar of 1.0 = 2012 levels

Skipjack MSE – HCRs

First projection year	2019
First year MP run	2022
First time HCR applies	2023
Interim period (2019-2022)	average 2016-18
Projection period	30 years
Management period	3 years
TRP	$SB/SB_{F=0}$ (2012)
Reference catch/effort year	**2012**
HCR fisheries	**All**
purse seine	**effort**
non-purse seine	**catch**
Archipelagic waters	**fixed at 2012**
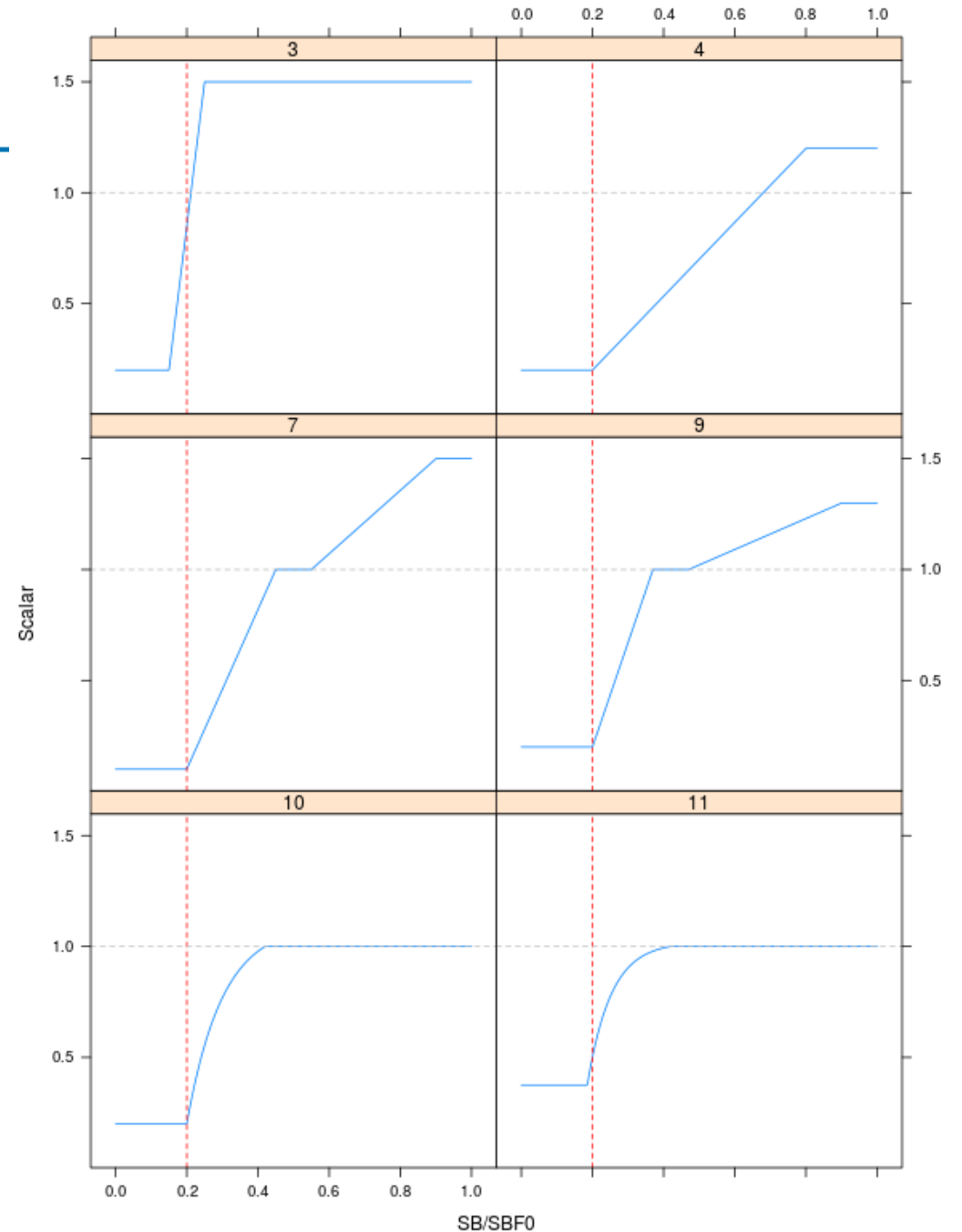
Skipjack MSE – Assumptions of the evaluations

Seasonal pattern of tropical purse seine effort during the reference year : 2012

Conditions consistent with 3 month FAD closure
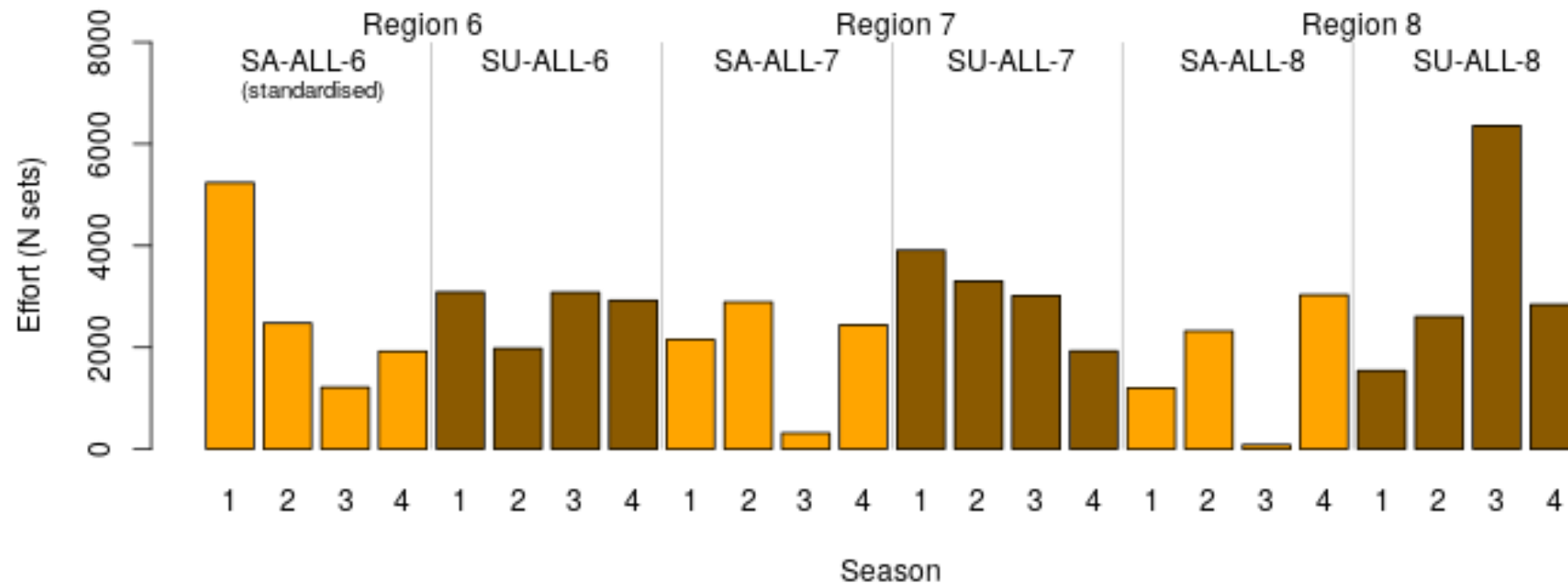
Assumptions for archipelagic waters PNG and SB
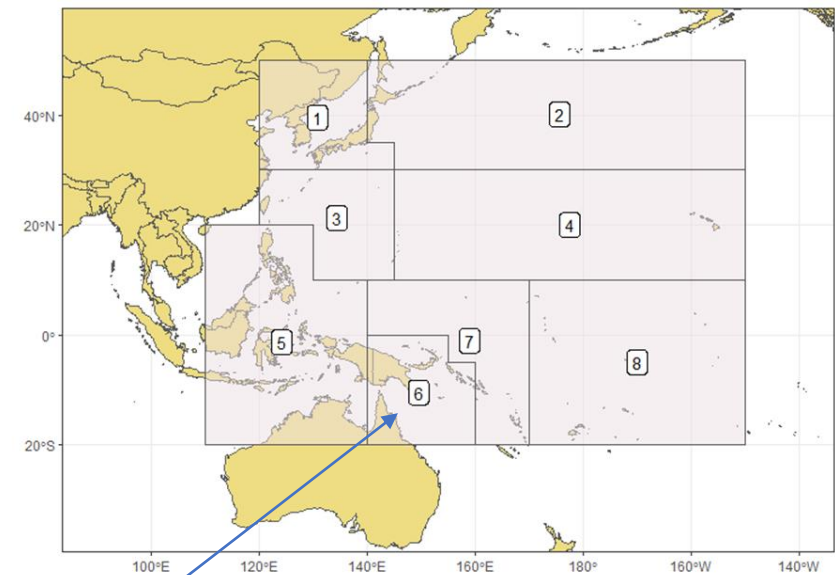
PNG & SB Archipelagic waters

- Adjusts the effort scaler to be applied to purse seine fisheries in **region 6**

- **Archipelagic waters effort remains fixed at 2012 levels**, the effort outside of archipelagic waters is adjusted according to the harvest control rule (HCR).

- Both free school and associated effort combined (SA-ALL-6, SU-ALL-6)

- <u>**Assumes**</u> **that purse seine fishing effort inside archipelagic waters continues at 2012 levels.**

- Note: Pole and line fishing in region 6 is controlled on catch (operates outside archipelagic waters)

Assumptions for archipelagic waters ID and PH
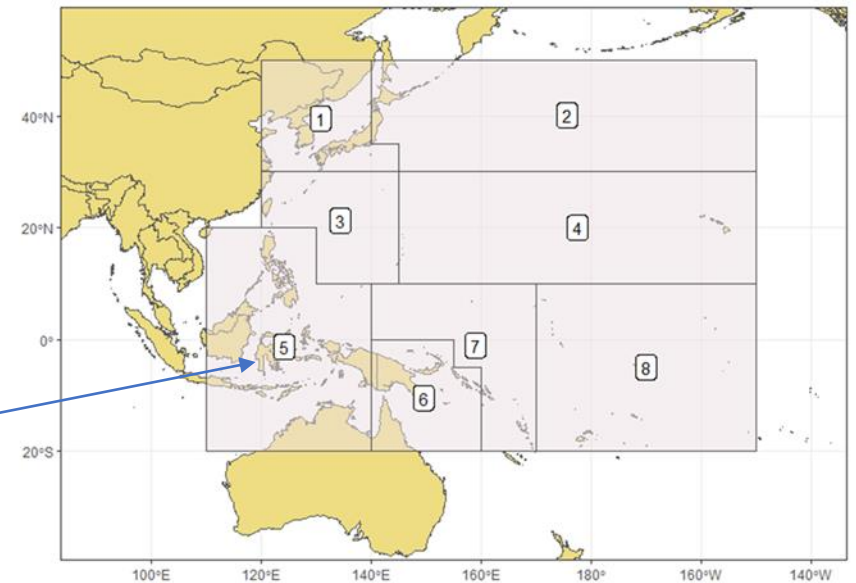
ID & PH Archipelagic waters (region 5)

- Adjusts the fishing scalar to be applied to fisheries in region 5

  - All catches from the ID domestic fishery (fishery 11), _controlled by catch_

  - Assume 50% of effort from the combined ID-PH purse seine fishery (fishery 12) are archipelagic set at 2012, the offshore ID-PH fishery has the HCR applied and _controlled by effort_

  - Assume 50% of catches from the pole and line fishery (fishery 13) are archipelagic, set at 2012 levels – the offshore pole and line has the HCR applied and _controlled by catch_

  (Based on Hoshino et al. (2020))

- **Main point:** _assumes that pole and line and purse seine fishing inside archipelagic waters continues at 2012 levels._

Skipjack MSE – Performance Indicators

Performance Indicator 1:   Maintain SKJ, YFT, BET biomass at or above levels that provide fishery sustainability throughout their range.

Performance Indicator 3:   Maximise economic yield from the fishery (average expected catch).

Performance Indicator 4:   Maintain acceptable CPUE.

Performance Indicator 6:   Catch stability.

Performance Indicator 7:   Stability and continuity of market supply (effort variation relative to a reference period).

Performance Indicator 8:   Stability and continuity of market supply (probability of and deviation from $SB/SB_{F=0}$ in 2012).

Performance Indicators 5, 9, 10 & 11 continue to be developed

Selecting a management procedure

- Three parts of a **management procedure**:

- *Data collection* (monitoring data)

  - E.g. catch statistics, tagging data, etc.

- *Estimation method* provides estimate of stock status

  - E.g. stock assessment, catch rate analysis, etc

- *Harvest control rule (HCR)* sets fishing opportunities.

- All three parts are agreed together

Data collection

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Estimation method

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Harvest control rule

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Catch / effort limit
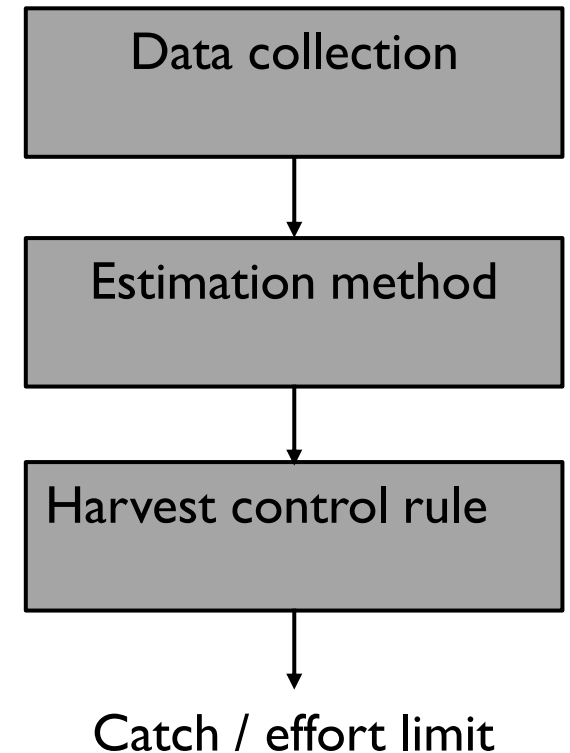
- Assemble a lot of 'candidate' MPs

- Test them using computer simulation (Management Strategy Evaluation)

- Measure the performance of each MP using **Performance Indicators**

- Remember that Performance Indicators relate to your **Objectives**

- Compare the Performance Indicators and choose your MP
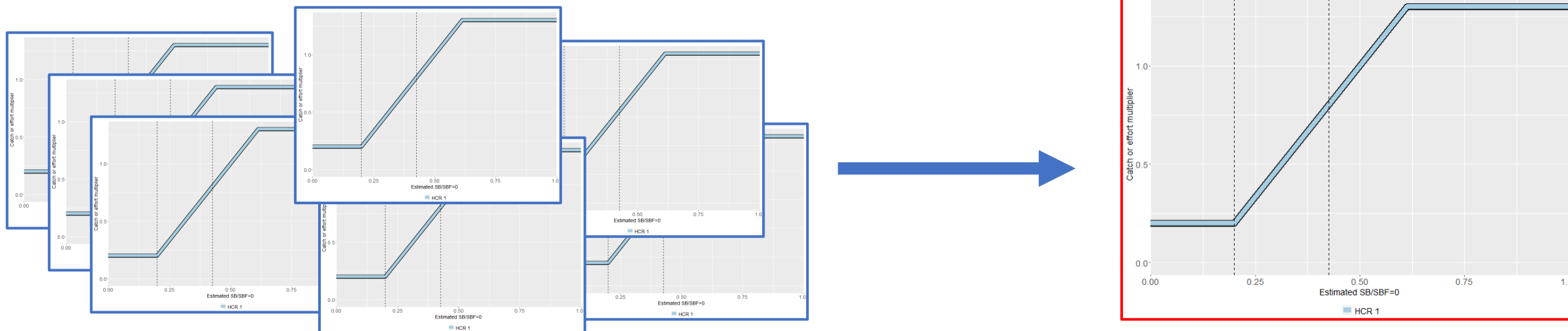
SKIPJACK PERFORMANCE INDICATORS

Indicator	Notes
Probability of SB/SBF=0 > LRP	Should be above 0.8.
Expected catch	Relative to average catch in 2013-2015. Presented for different fishery groupings and model areas.
Catch Per Unit of Effort (CPUE) – catch rate	Relative to CPUE in 2012. For purse seines in model areas 6, 7 and 8 only.
Catch stability	Scaled between 0 and 1. 1 is stable (never changes), 0 is very unstable (relative to the other MPs).
Effort stability	Scaled between 0 and 1. 1 is stable (never changes), 0 is very unstable (relative to the other MPs).
Proximity to SB/SBF=0 in 2012	Measures how close SB/SBF=0 is to the 2012 level on average. Scaled between 0 and 1. 1 is exactly at 2012 levels. 0 is as far from 2012 levels as possible.
SB/SBF=0	

- Generally, the higher the value the better, depending on your objectives
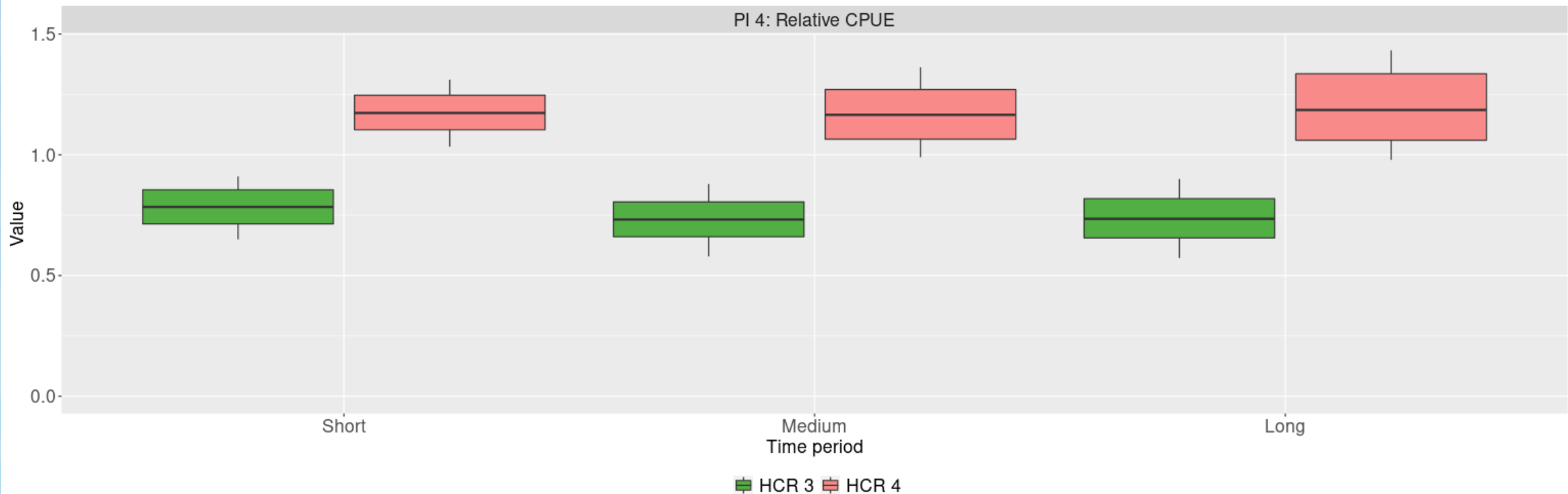
CATCH STABILITY
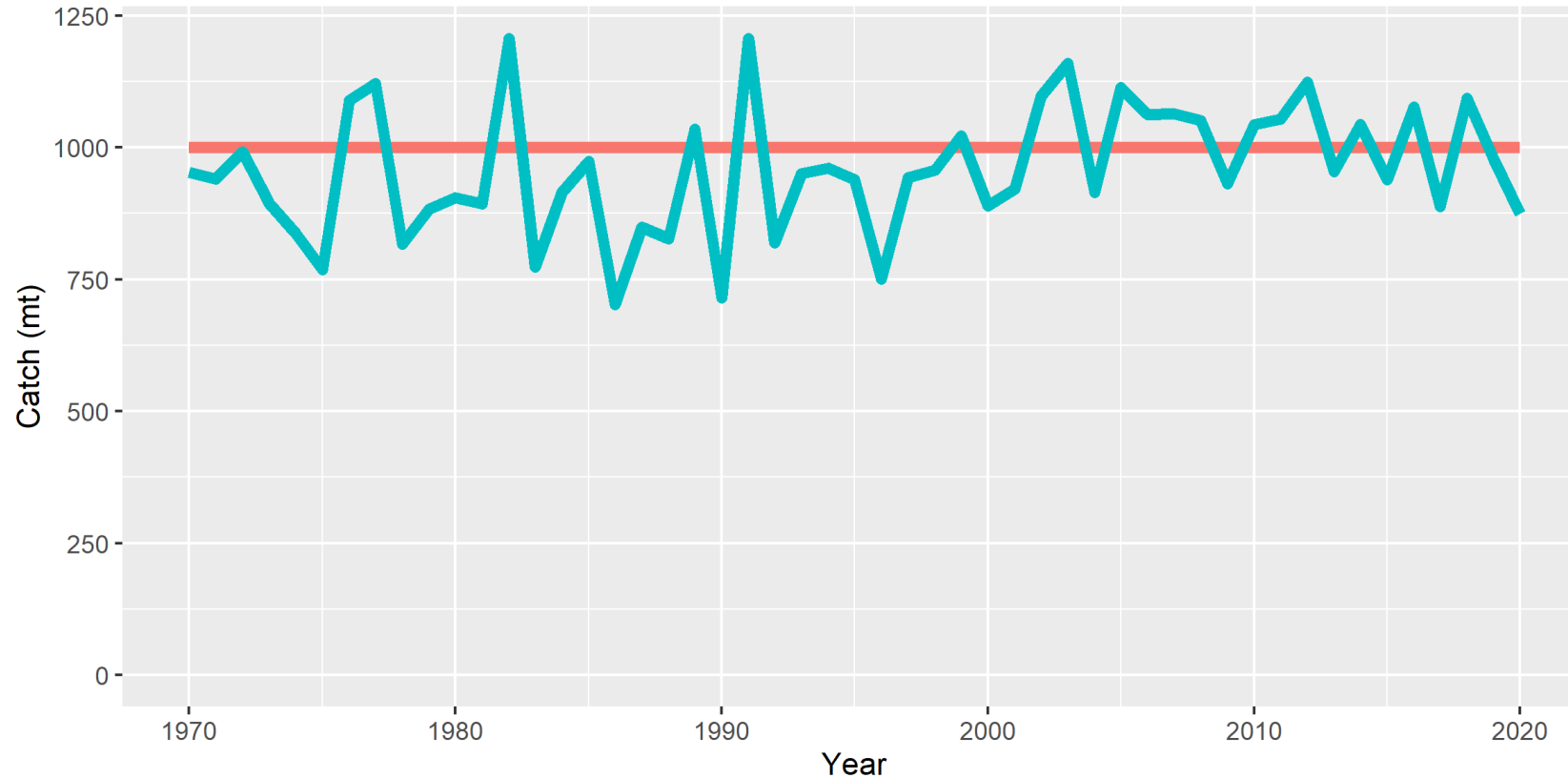
Stability ranges between 0 and 1

Stability of 1 means that it never changes in time

Lower stability means it changes a lot in time

TIME PERIODS AND UNCERTAINTY

PI 4: Relative CPUE

HCR 3 ▬ HCR 4

- Each indicator is reported over three time-periods:
  - Short-term: 2022-2030
  - Medium-term: 2031-2039
  - Long-term: 2040-2048

- Each indicator has a range of values – uncertainty.
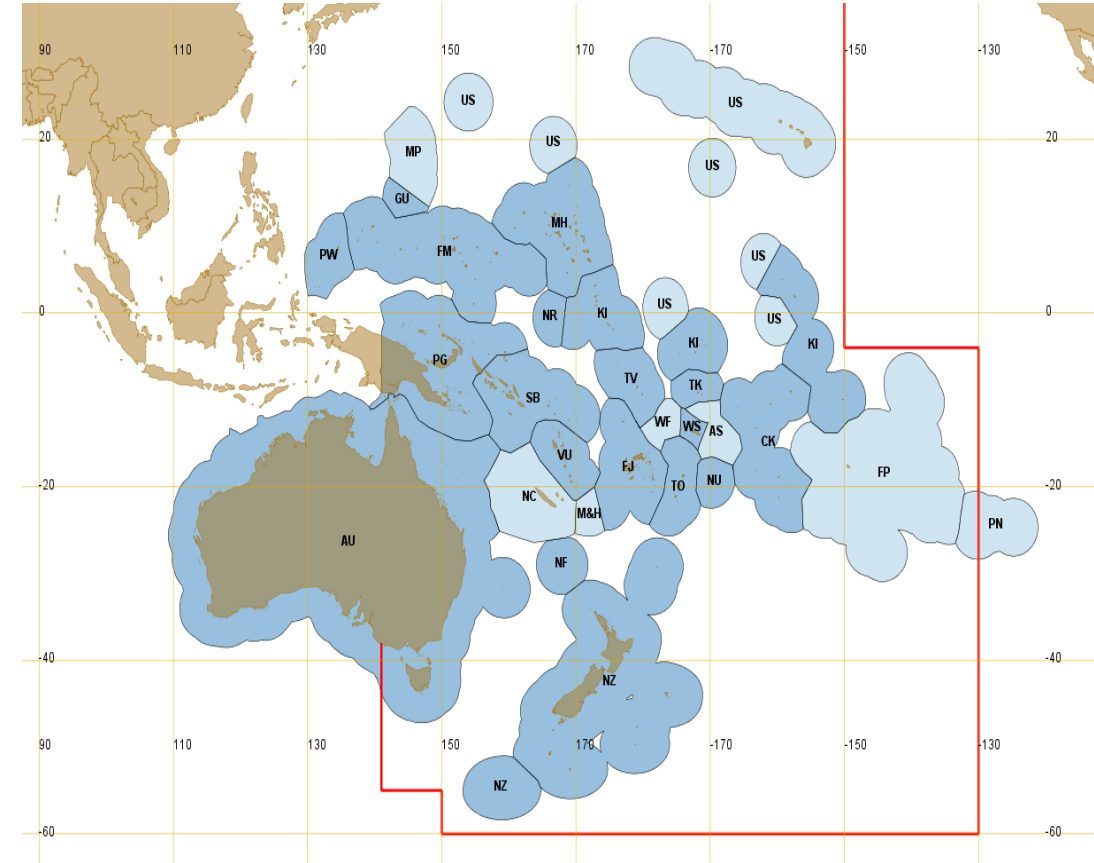
- The bigger the range, the less certain we are about the value.

OBJECTIVES AND HARVEST STRATEGIES

- WCPFC harvest strategy is at the regional scale

- Current assumption all fisheries are equally affected by the same proportional change in effort or catch

  "*Sets size of the pie, not how that pie is divided*"

- How can your national / sub-regional objectives be achieved through a harvest strategy?

- Which performance indicators to focus on?

- What needs to happen at the large regional scale for you to achieve your objectives?

- Can the harvest strategy create an environment in which they can be achieved?

PIMPLE

https://ofp-sam.shinyapps.io/pimple2022/

PRACTICAL EXAMPLE 1

- Main objective: Maximise overall profit from the fishery

- What needs to happen to achieve this:

  - Lots of things…

  - Being at or close to the TRP on average should provide good economic performance.

- Look for HCRs that gets you close to the TRP on average (if there is a TRP…)

- Might need to look at other criteria too

- Main objective: Develop onshore processing facilities

- What needs to happen to achieve this?:

  - High enough catches

  - Stable catches

- Look for HCRs that avoids large or frequent changes in catch (*good catch stability*), while ensuring enough catches (*good catches*).

- Is it more important to have high catches or high stability? – Possible trade-off

MIXED FISHERIES

	Tropical longline	Southern longline	Northern longline	Pole and line	Purse seine	Other
SP Albacore	0.14	0.82	0	0	0	0.04
Bigeye	0.33	0.05	0.08	0.03	0.41	0.10
Skipjack	0	0	0	0.09	0.80	0.11
Yellowfin	0.09	0.03	0.01	0.04	0.63	0.20

Proportion of average catch by weight (2015-2017)

- Management measures aimed at one stock can have impact on other stocks;

- May not be appropriate to consider the management of individual stocks in isolation;

- Current approach: single stock MPs for SKJ, BET and BET;

- Work has been presented at SC and is still being developed.

Wrap up

Science Management Dialogue

Key considerations for managers

- Procedure for selecting the 'best performing' management procedure
- Approach for implementing the agreed procedure
- Adoption of Target Reference Points (TRPs) that define desirable states of a stock and fishery
- Definition of fishery controls within the harvest strategy
- Input into candidate Harvest Control Rules (HCRs)
- Feedback on presentational approaches to support decision making
- Development of the monitoring strategy

Contact us

Contact us: fame-harvest-strategies@spc.int

Science Management Dialogue: 19th and 22nd August 2022