



Pacific
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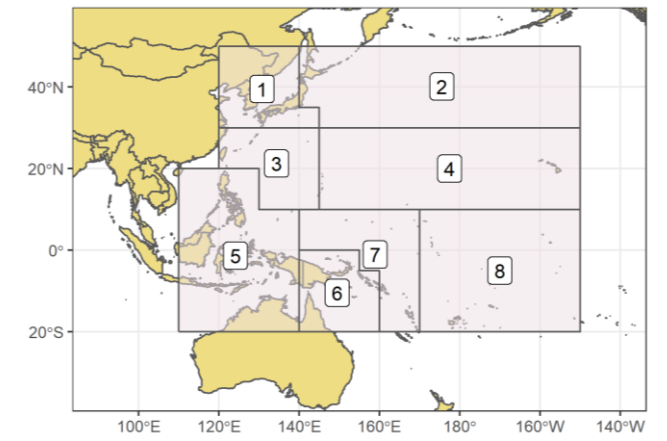
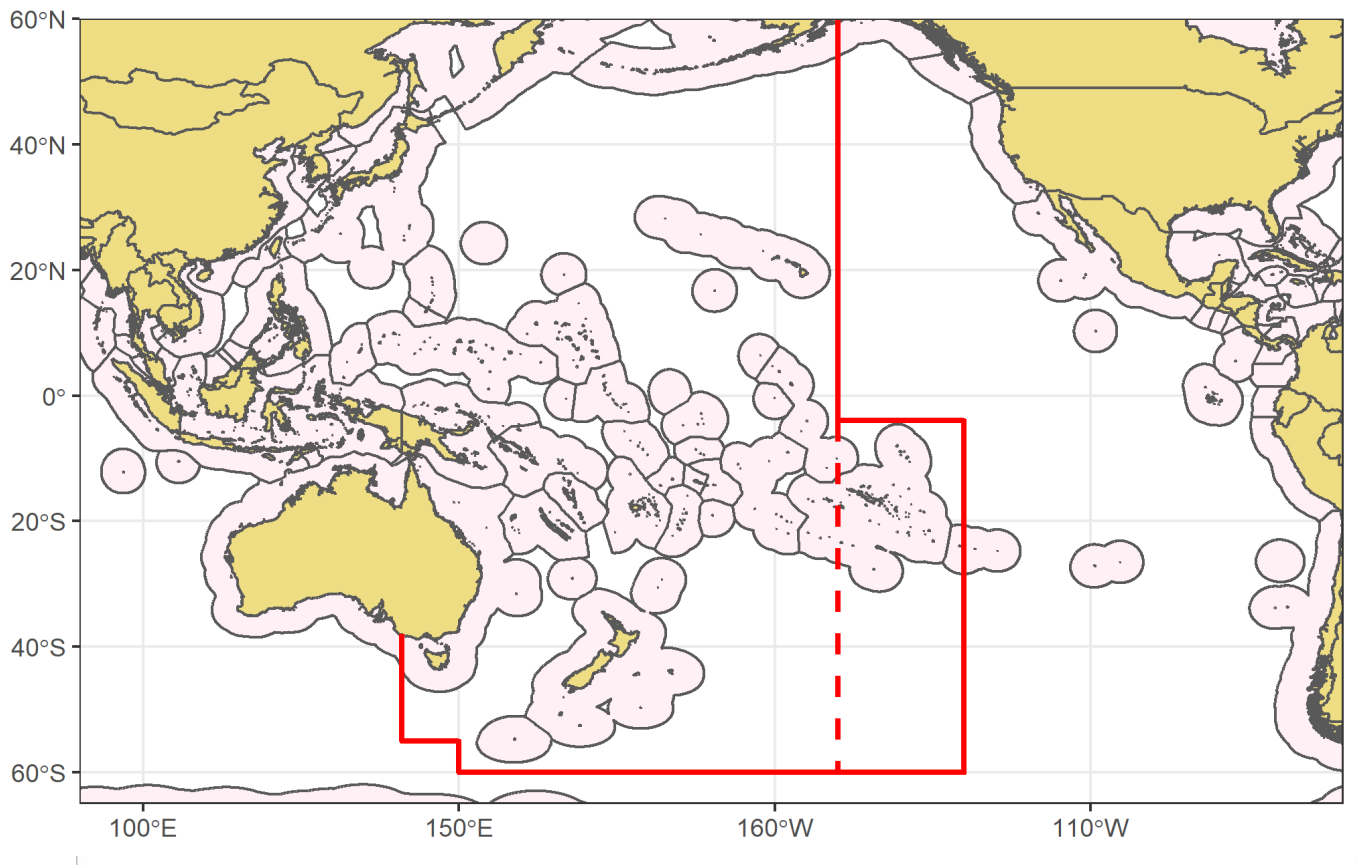
The Pacific Tuna MSE Project

ROBERT SCOTT, FINLAY SCOTT

OCEANIC FISHERIES PROGRAM, FAME, SPC

FUNDED BY THE NEW ZEALAND MINISTRY OF FOREIGN AFFAIRS AND TRADE (MFAT)

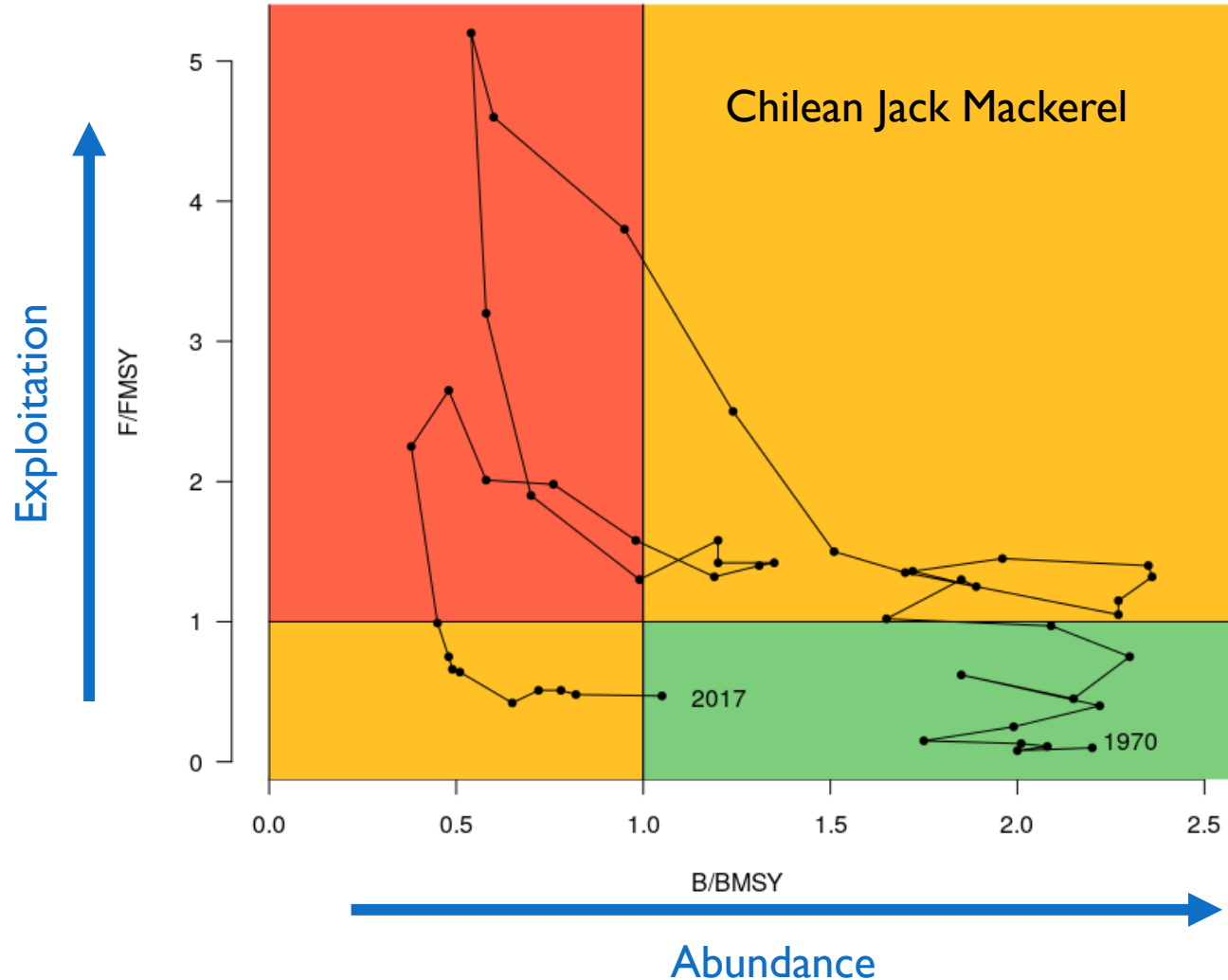
WCPFC Harvest Strategy Approach



COMMISSION
ELEVENTH REGULAR SESSION
Faleata Sports Complex, Apia, SAMOA
1 - 5 December 2014

CONSERVATION AND MANAGEMENT MEASURE ON ESTABLISHING A HARVEST STRATEGY FOR KEY FISHERIES AND STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

WHY HARVEST STRATEGIES?



- Time lag in data collection.
- Stock assessments often more uncertain for the most recent period.
- Environmental factors
 - Recruitment
 - Ecosystem effects
- Time lag in management implementation.
- Negotiated outcomes often lead to 'watered down' and delayed management action.

HARVEST STRATEGY APPROACH

- Provides a framework for applying an evidence and risk-based approach to setting fishing levels.
- Management decisions are more consistent, predictable and transparent.
- Management action is timely .
- Specify the management actions necessary to achieve defined objectives for the fisheries.
- Contain a tailored **process for determining stock status and pre-defined rules that manage the fishery** in order to attain the objectives.



COMMISSION
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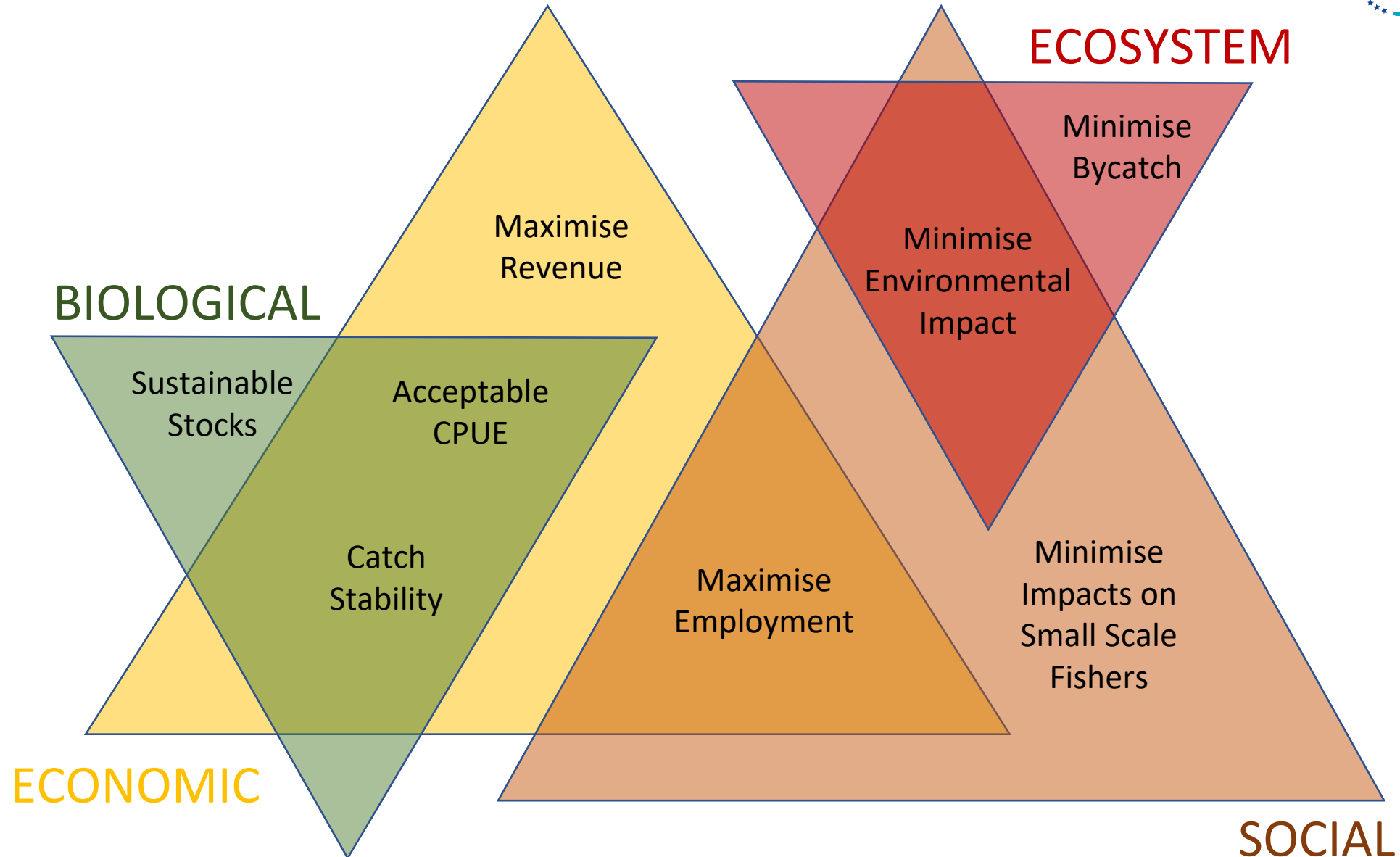
CONSERVATION AND MANAGEMENT MEASURE ON ESTABLISHING A HARVEST STRATEGY FOR KEY FISHERIES AND STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

Conservation and Management Measure 2014-06

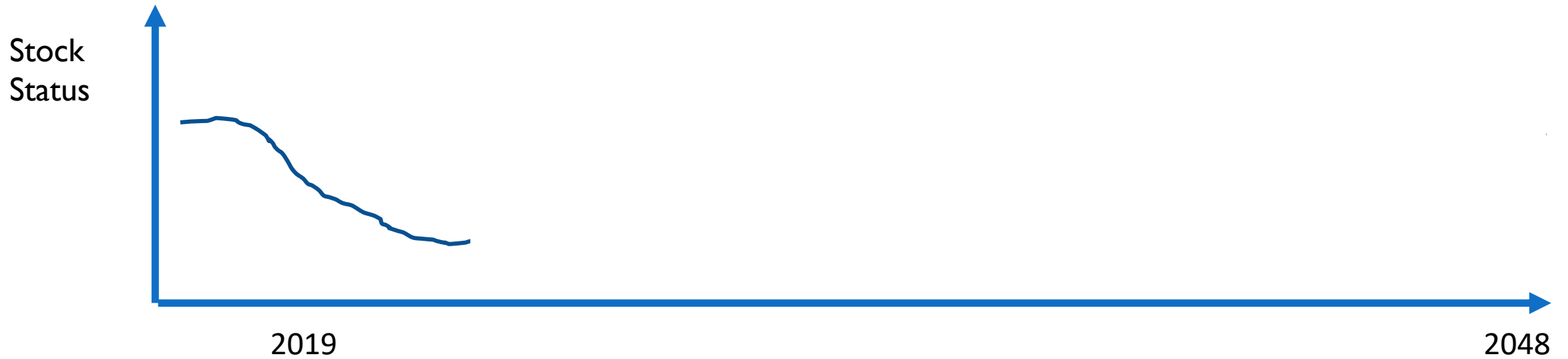
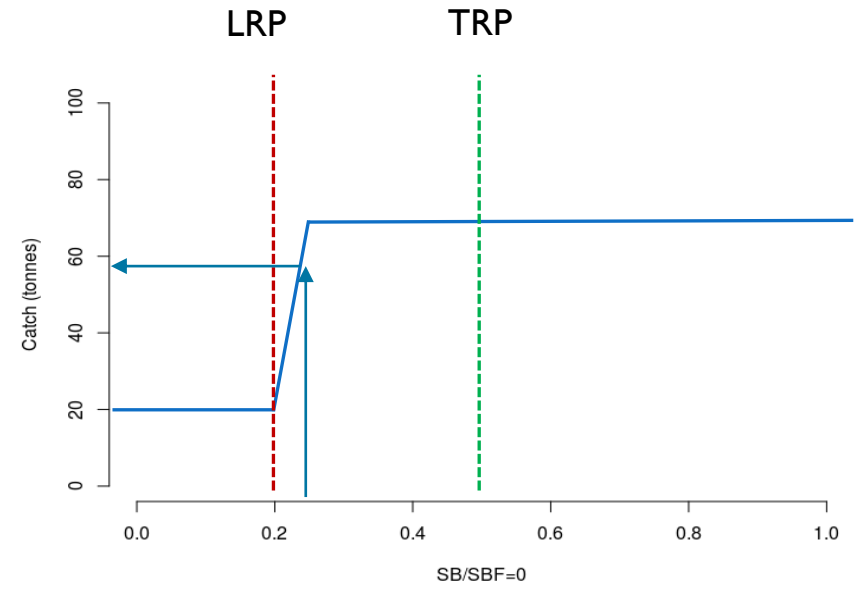
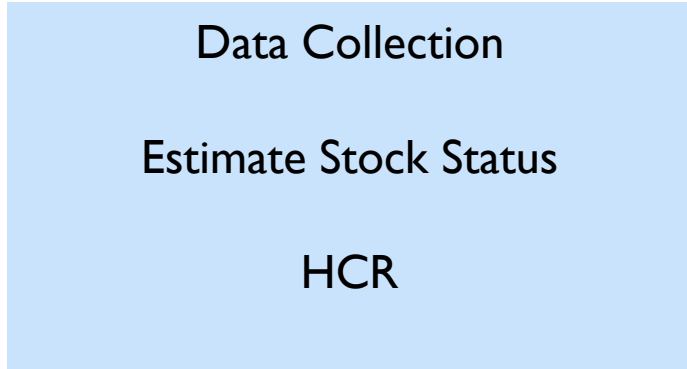


Western & Central Pacific Fisheries Commission

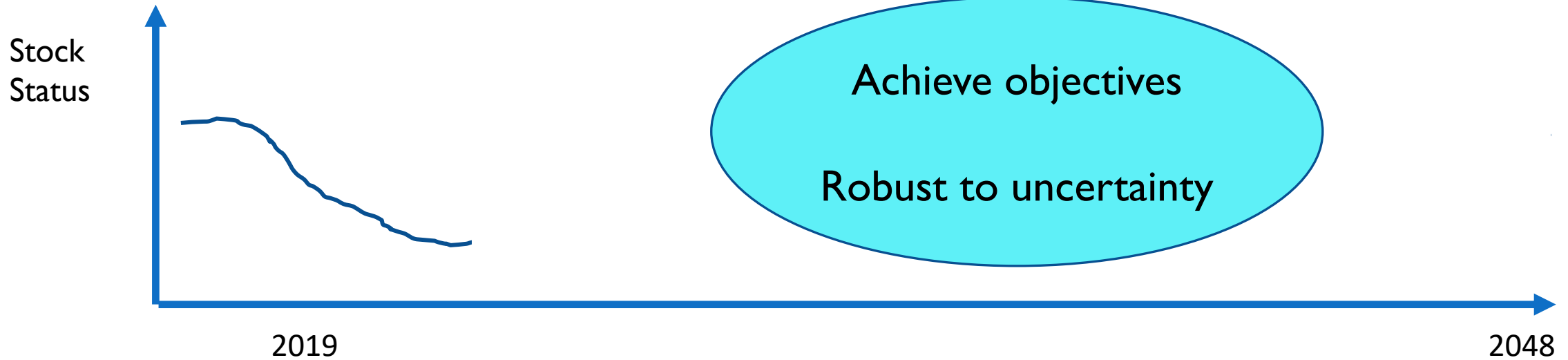
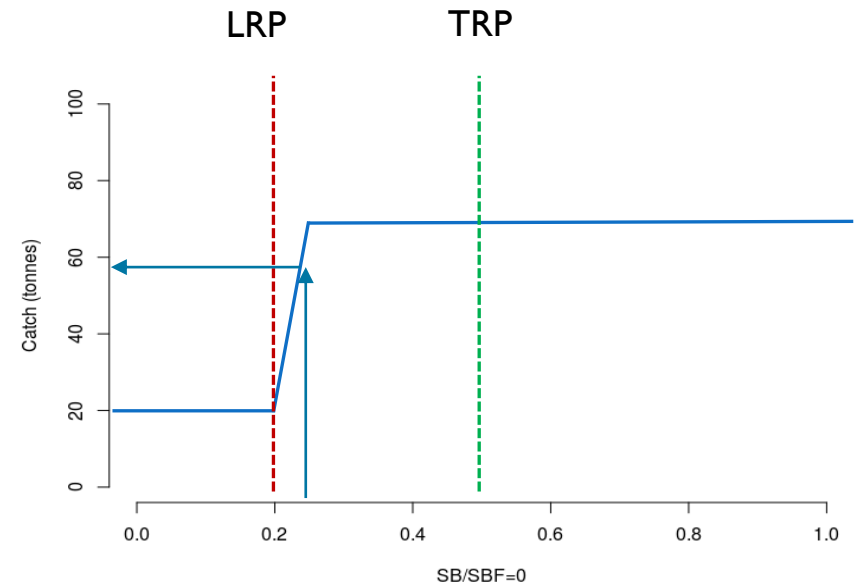
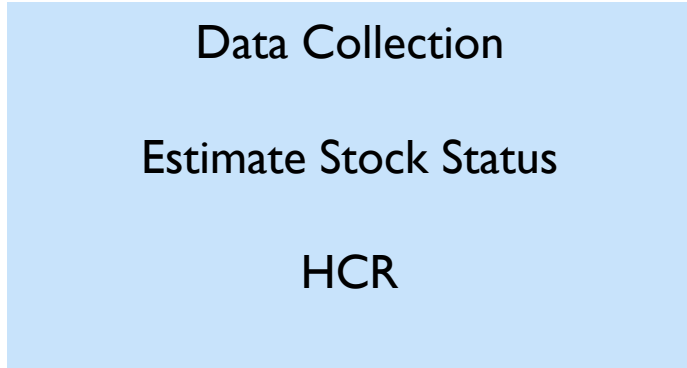
MANAGEMENT OBJECTIVES



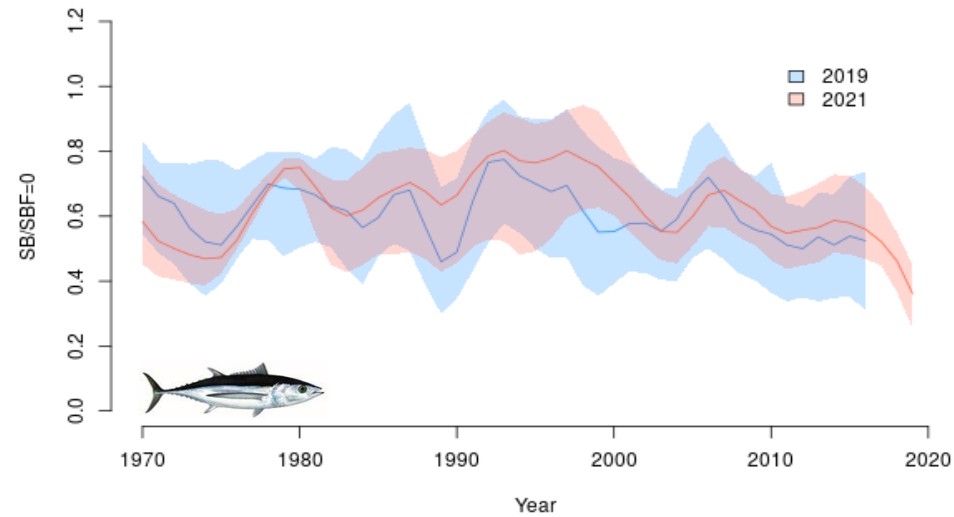
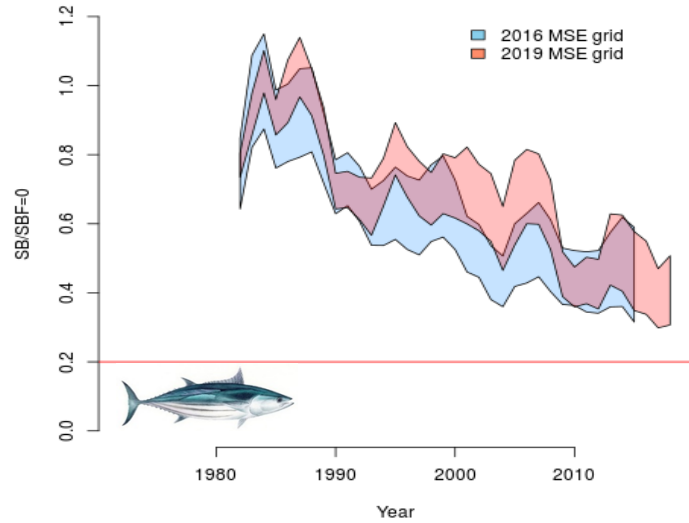
THE MANAGEMENT PROCEDURE



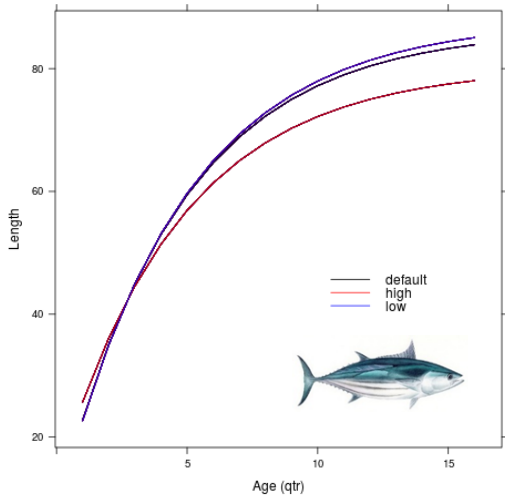
THE MANAGEMENT PROCEDURE



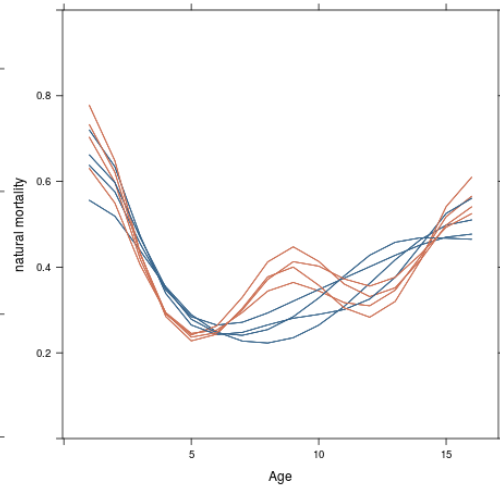
ACCOUNTING FOR UNCERTAINTY



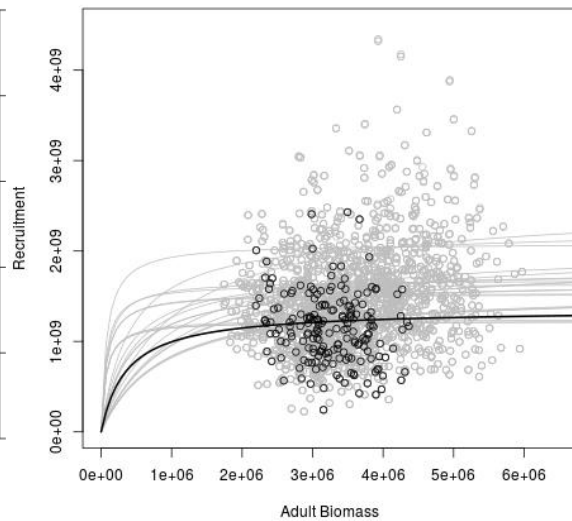
Growth



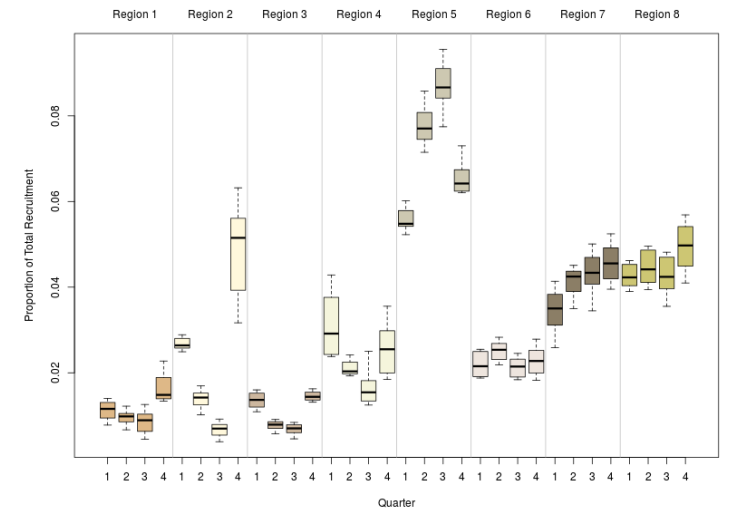
Natural Mortality



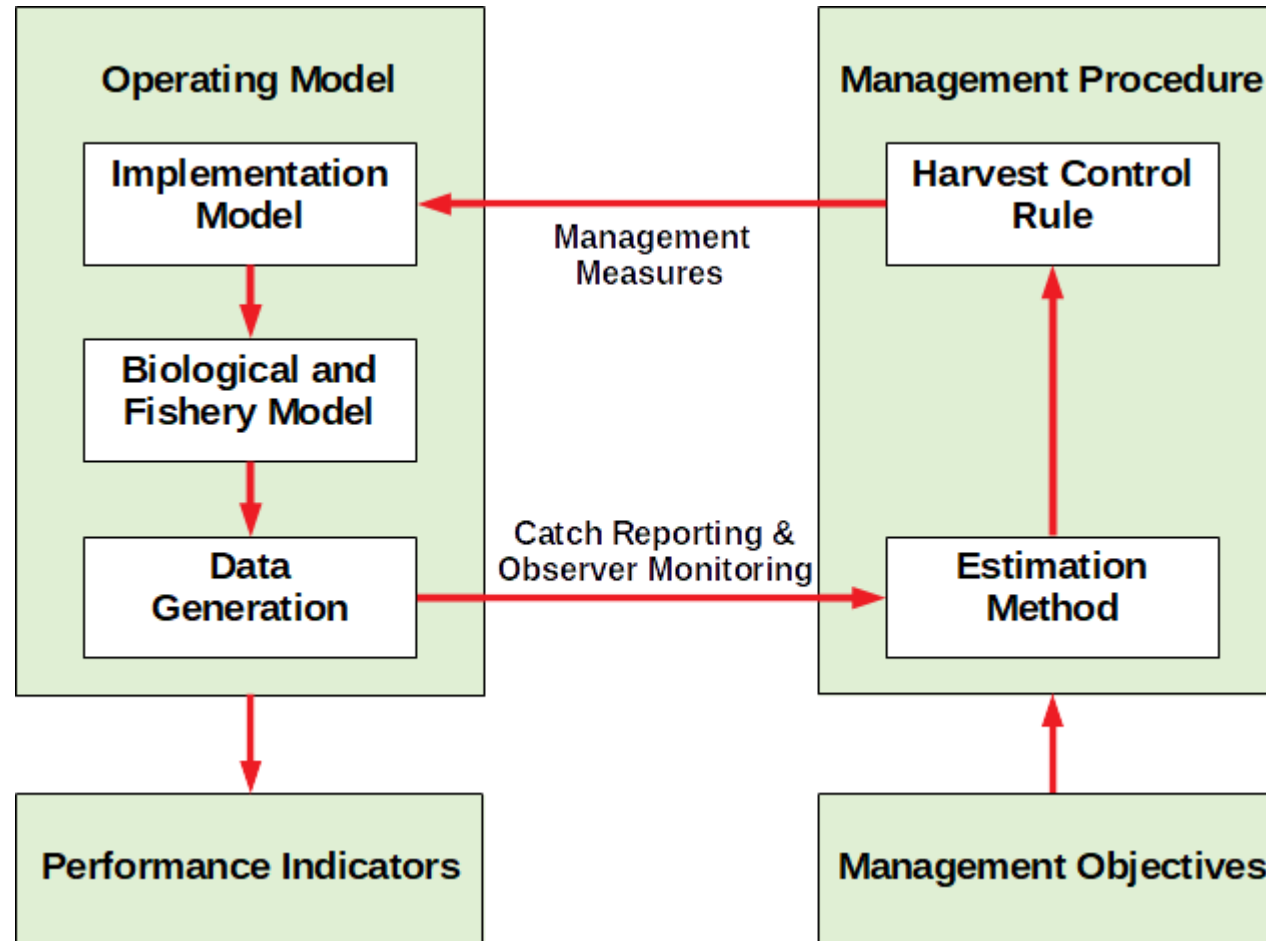
Recruitment



Recruitment Distribution



MSE - MANAGEMENT STRATEGY EVALUATION



ACCOUNTING FOR UNCERTAINTY



Axis	Levels		Options		
	Reference	Robustness	0	1	2
Recruitment variability	2		1982-2014	2005-2014	
Catch & effort	1	1	20%	30%	
Size composition	1		Estimated Effective Sample Size – All Models		
Tag recaptures	1	X	Status quo		
Steepness of SRR	3		0.8	0.65	0.95
Tag mixing period	2		1 qtr	2 qtr	
Growth	2			Low	High
Movement	1	X	estimated		
Hyper-stability in CPUE	2	1	0	-0.5	-0.9
Effort creep	2	1	0%	2%	3%

96 scenarios

10 iterations each scenario

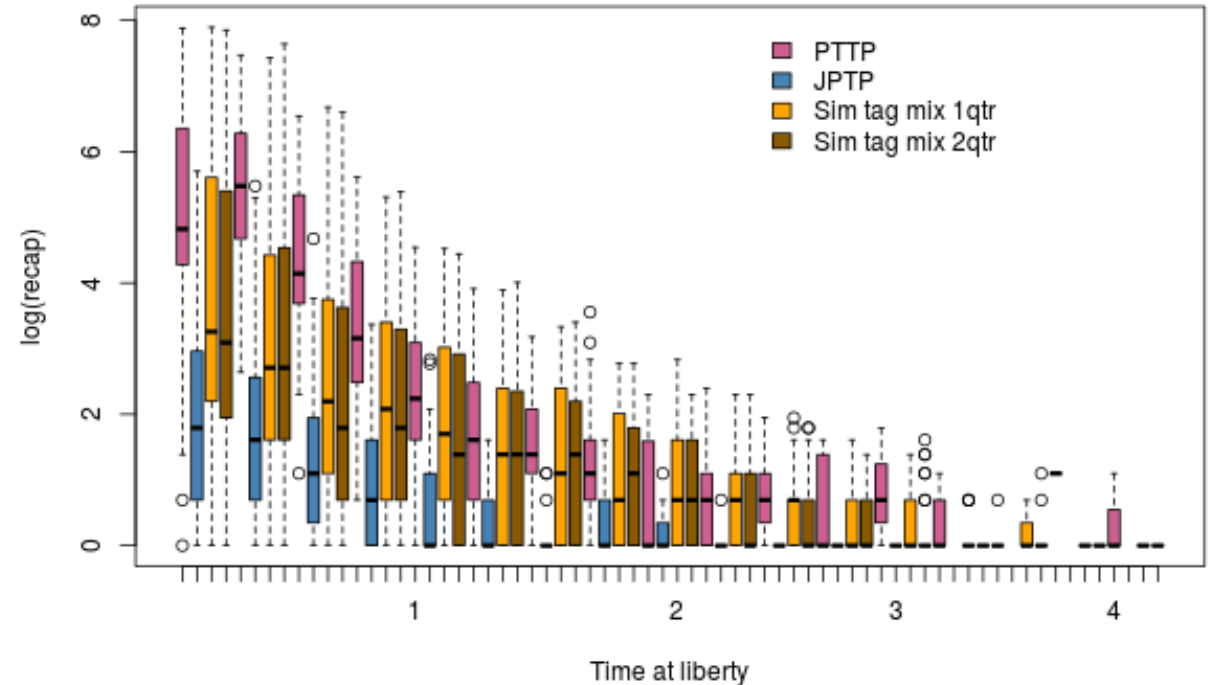
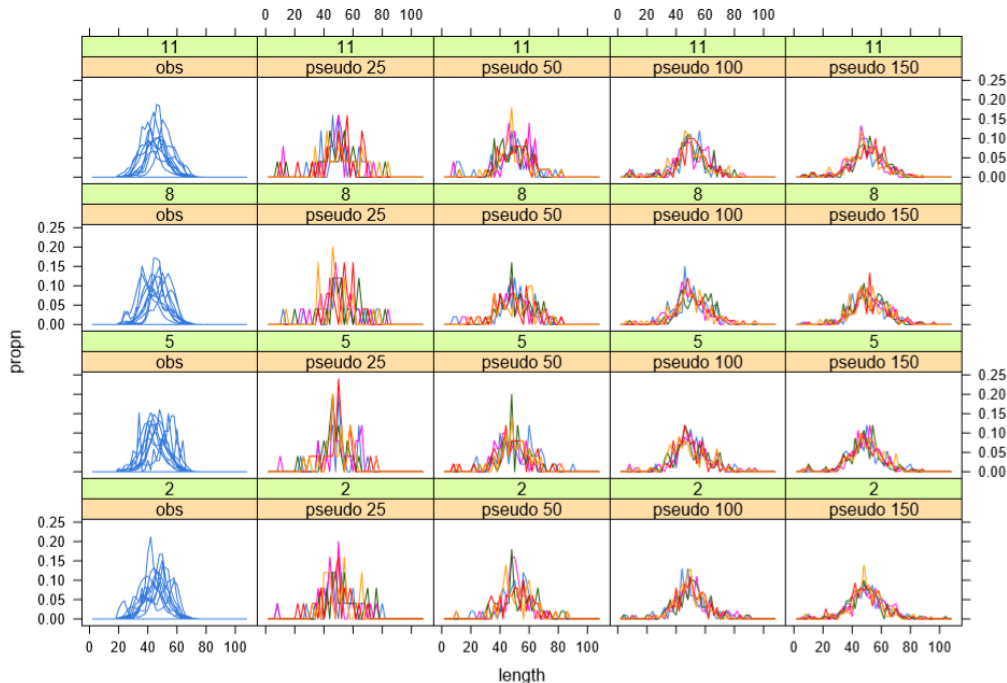
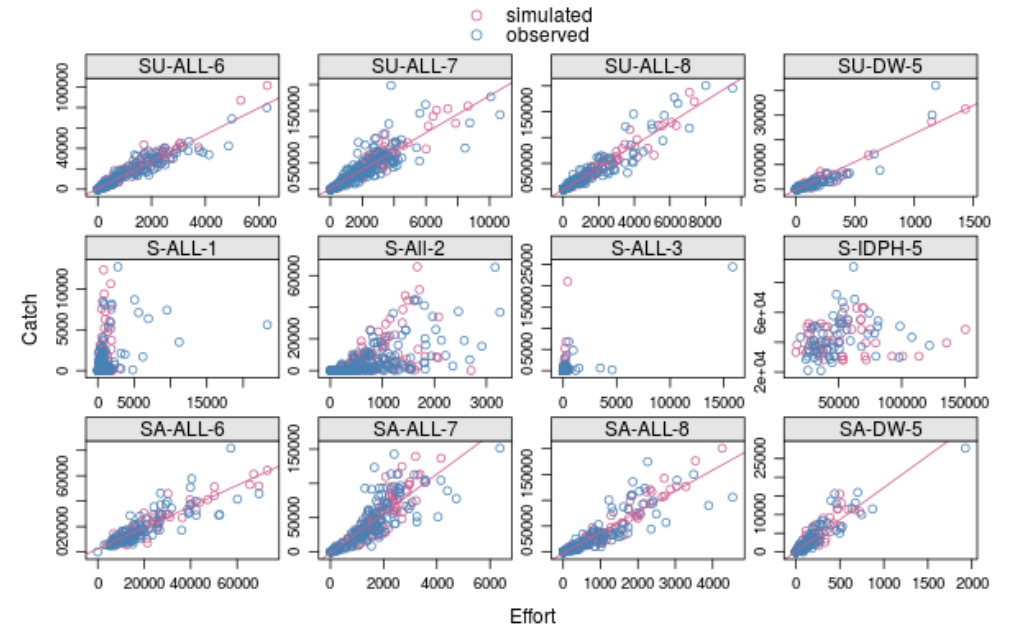
960 evaluations for each HCR

Reference set shown in black – used for PI calculation

Robustness set not fully developed

SIMULATING DATA

- The Operating Model must simulate future conditions that are sufficiently realistic to ensure adequate testing of the Management Procedure.
- Turing Test (ish)
 - Can you tell, from visual inspection, if the data have been generated by a computer?



SIMULATING FUTURE SCENARIOS

Robustness Set

Seapodym

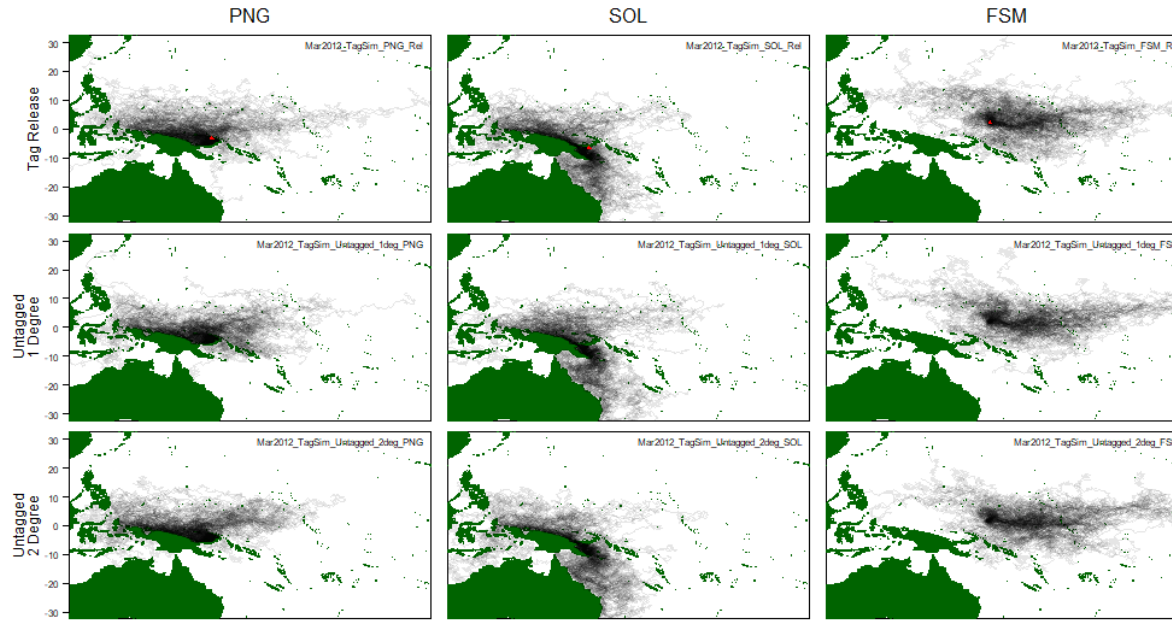
Movement dynamics

Climate change

Ikamoana

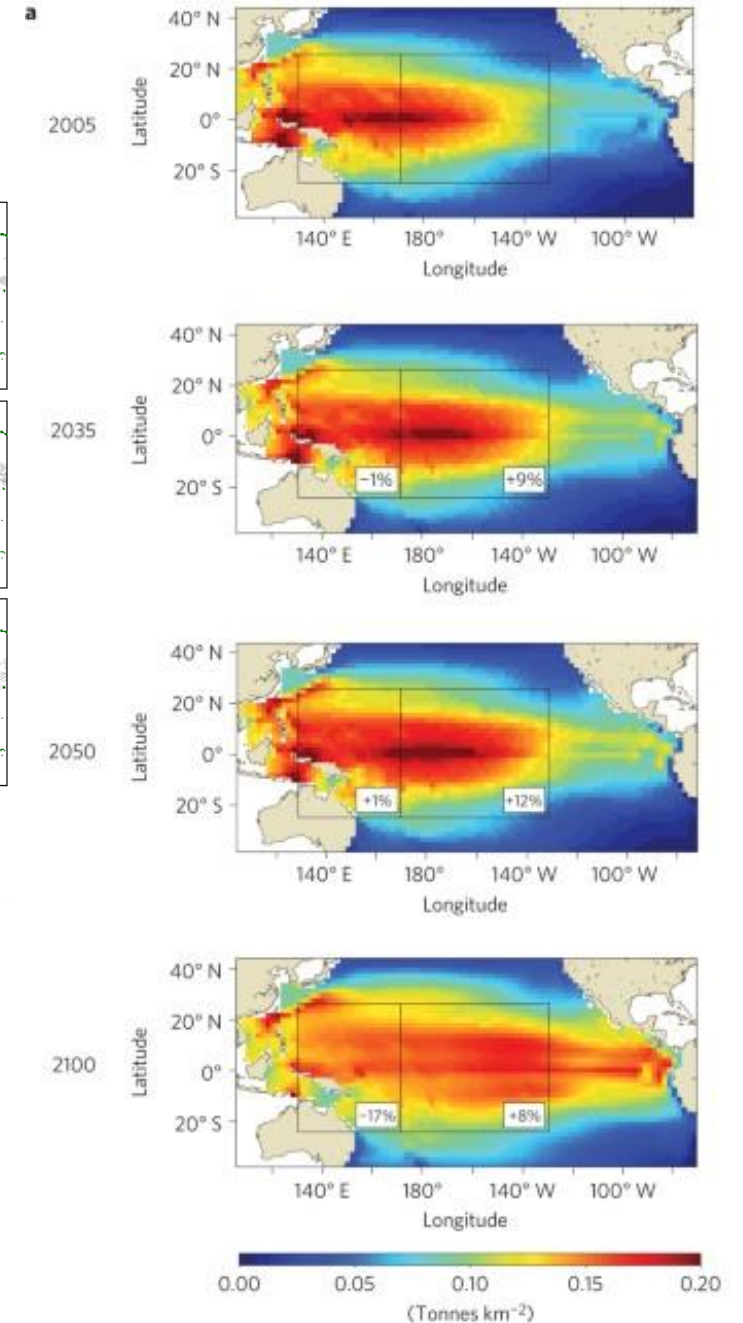
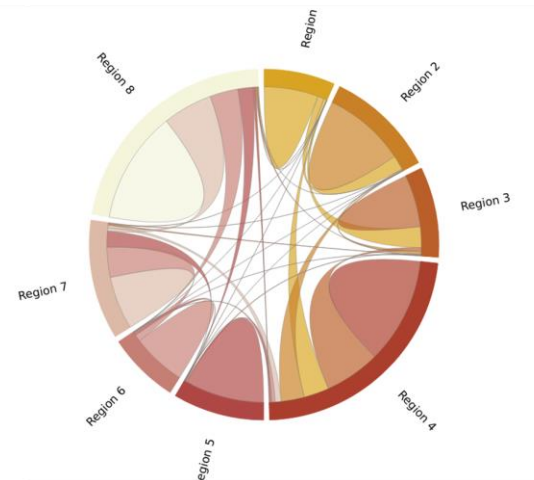
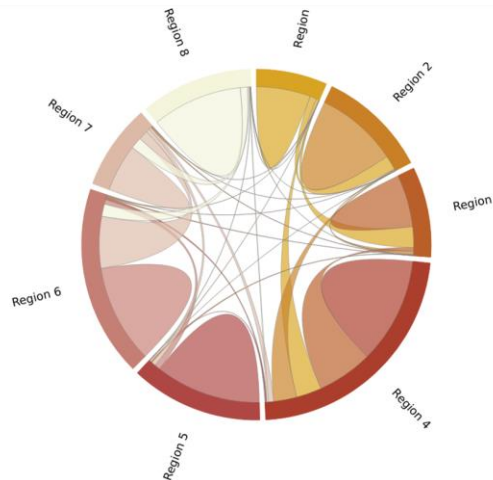
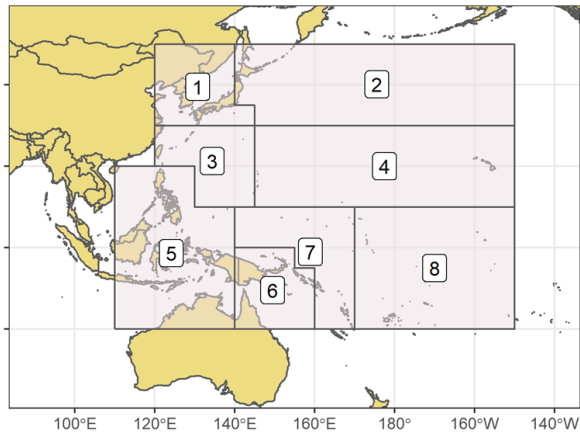
Tagging scenarios

Tag mixing hypotheses



La Nina

El Nino



SKIPJACK MSE – HCRS

First projection year 2019
 First year MP run 2022
 First time HCR applies 2023

Interim period (2019-2022) average 2016-18

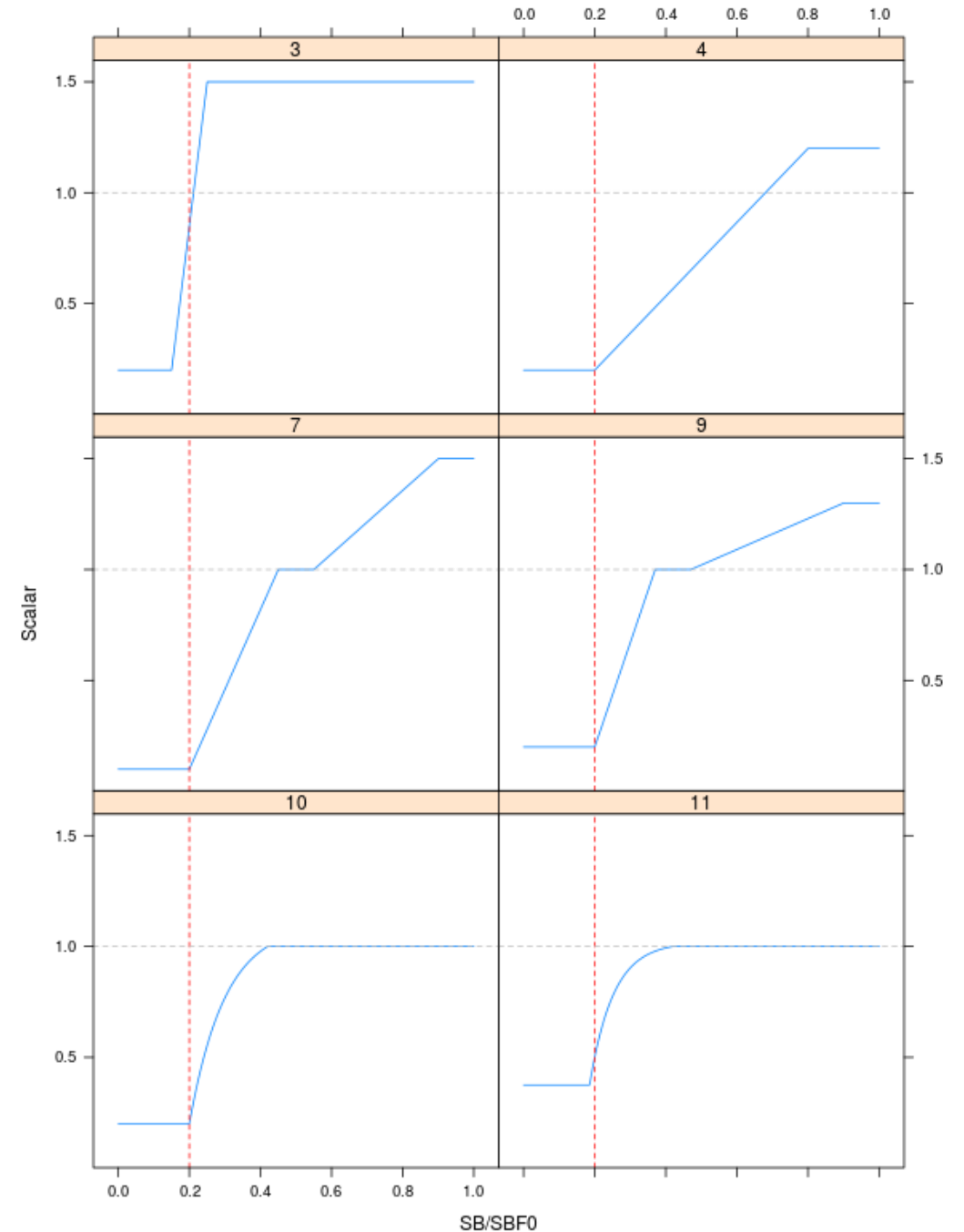
Projection period 30 years
 Management period 3 years

TRP SB/SB_{F=0} (2012)

Reference catch/effort year **2012**

HCR fisheries **All**
 effort
 catch
 catch

Archipelagic waters **fixed at 2012**



Technical Challenges



- Estimation model within the MP uses an integrated assessment model (by necessity).
- Simulating tag release and recapture data
- Stock structure and mixing assumptions



- Simulating CPUE data that look like real CPUE data



- Increased uncertainty in recent assessments (optimistic ?)
- Mixed fishery interactions – Longline vs Purse Seine



MULTIFAN-CL
A length-based, age and spatially-structured model
for fisheries stock assessment

- Wrestling with MFCL – extensive file manipulation
- Lengthy run-times

Technical Modelling



MSE Framework

OM - MFCL

developments (self scaling multinomial; density dependent catchability, ...)
data generator (catch, effort, size composition, tag recapture)

EM – model based, empirical

CPUE, length based, simple biomass dynamic models
complex integrated assessment models

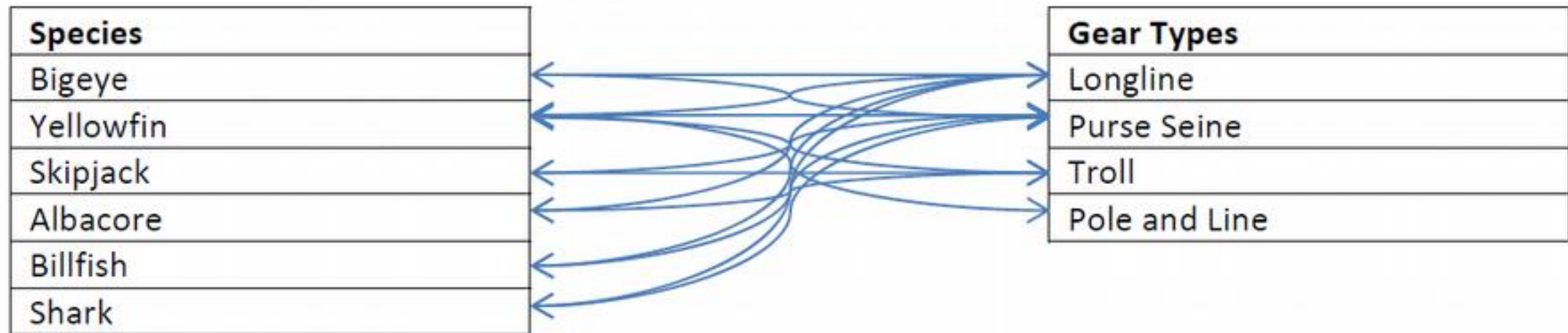
FLR4MFCL - file manipulation

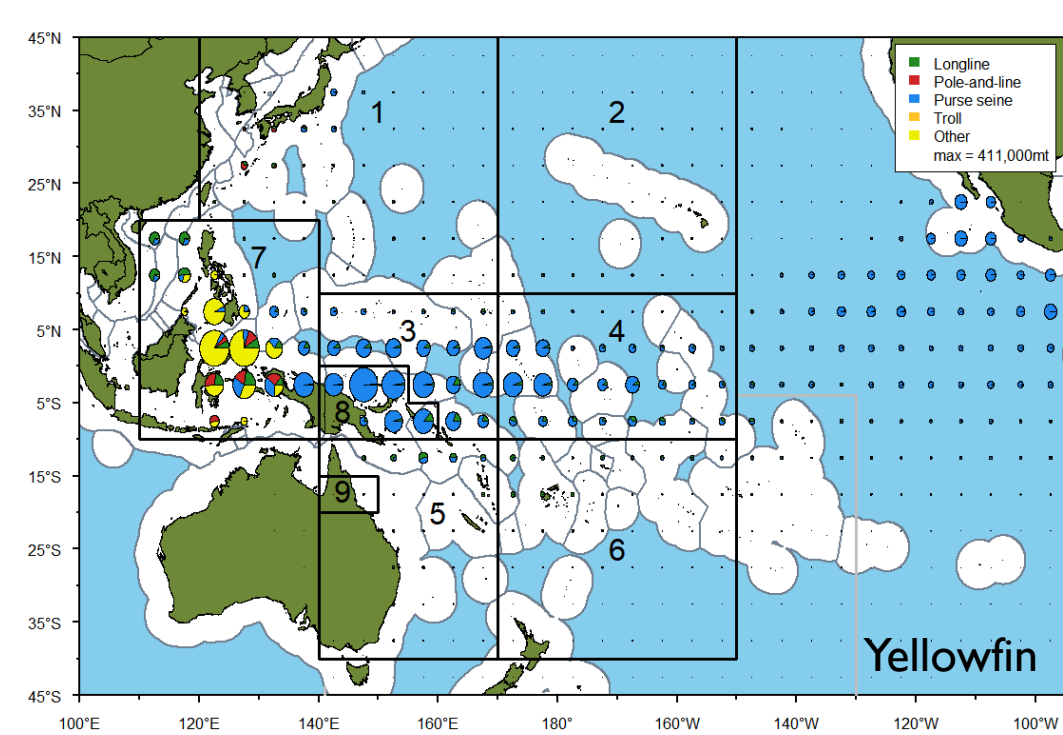
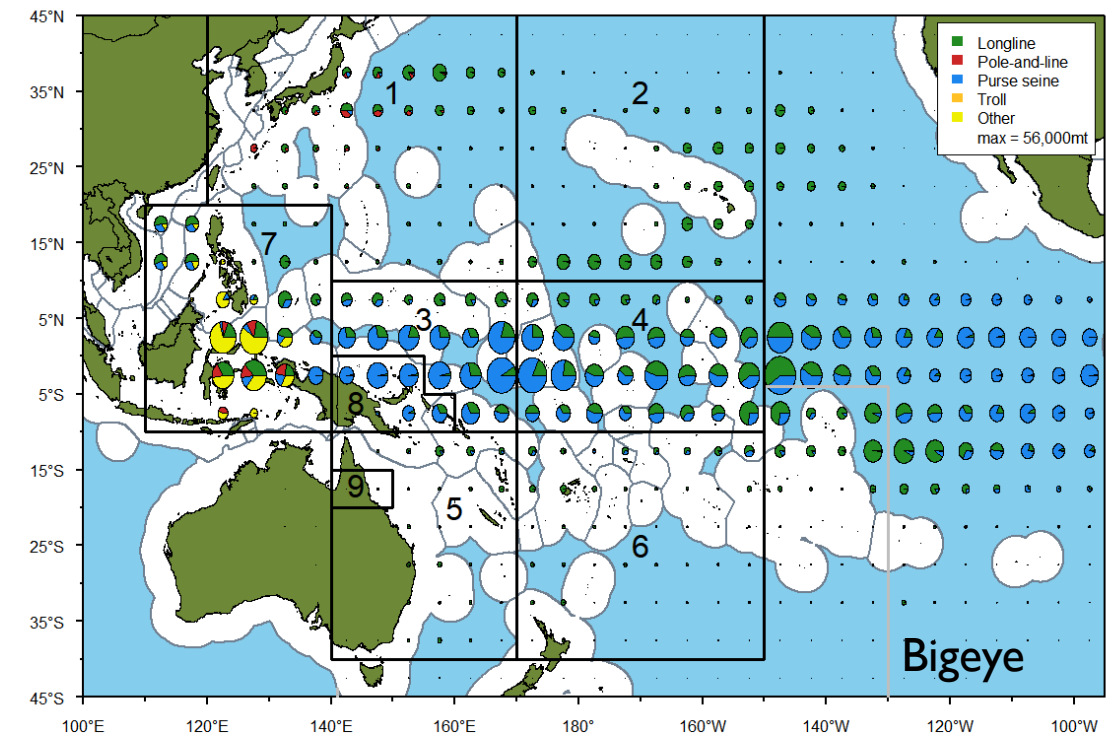
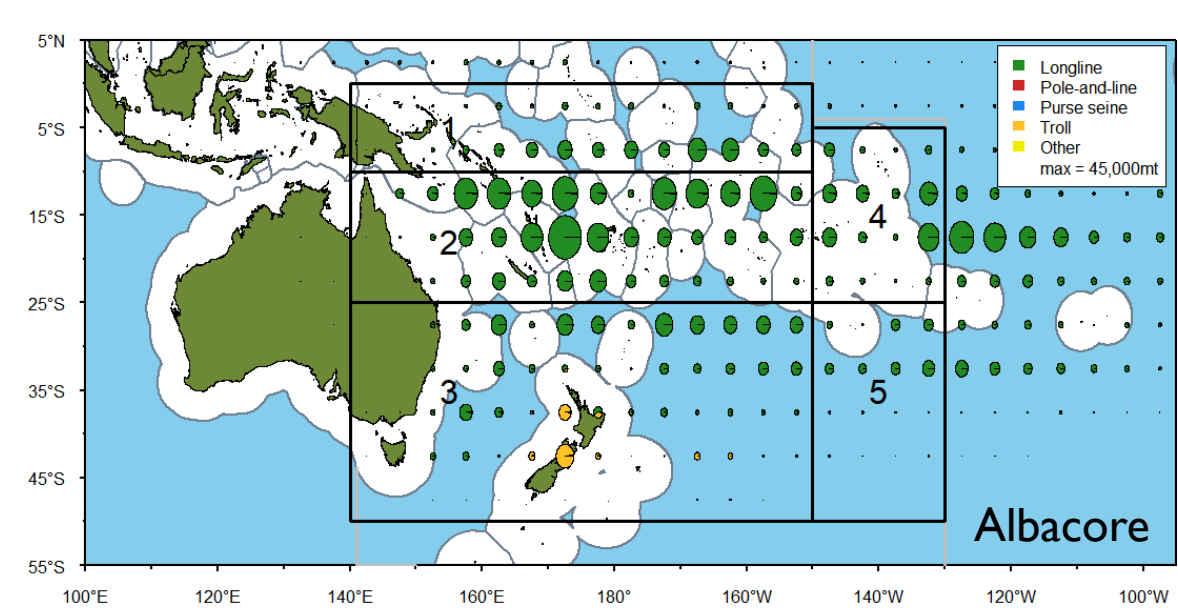
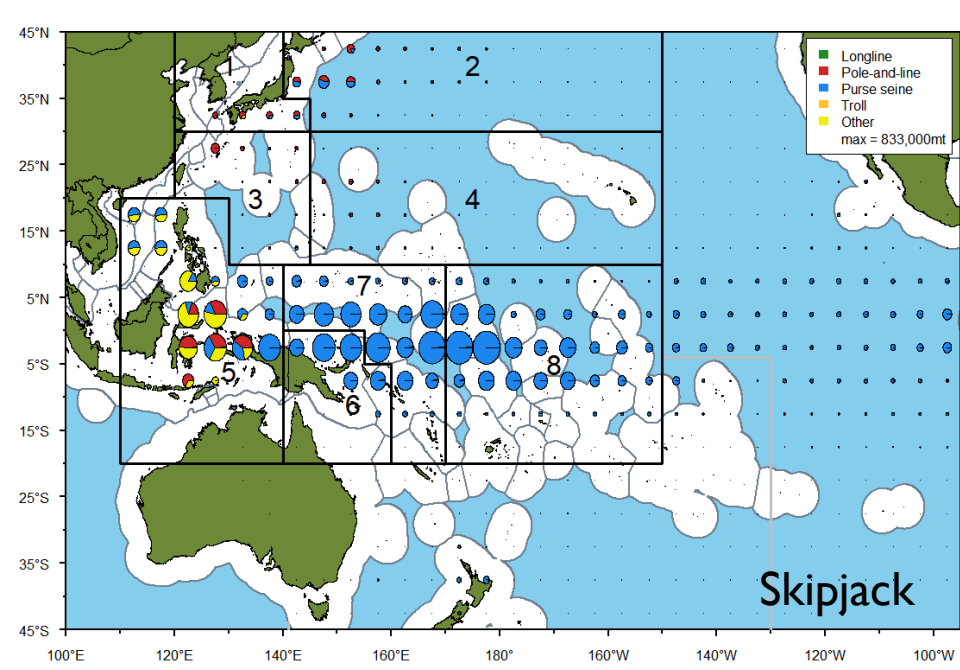
HTCondor – 2019 ~ 830,000 CPU hours (95 CPU years)
12 months ~1,048,186 CPU hours (120 CPU years)

R Shiny – interactive results interpretation and decision making

MIXED FISHERIES

- Harvest strategies for WCPFC skipjack, bigeye, yellowfin and South Pacific albacore;
- The four stocks are caught by an overlapping mix of fisheries with different gears in overlapping regions.





WHAT IS CATCHING WHO?

	Tropical & Northern longline	Southern longline	Pole and line	Purse seine	Other (domestic)
SP Albacore	0.14	0.86	0	0	0
Bigeye	0.43	0.04	0.02	0.39	0.12
Skipjack	0	0	0.08	0.78	0.14
Yellowfin	0.14	0.03	0.03	0.56	0.24

Proportion of average catch by weight (2016-2018)

- 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.

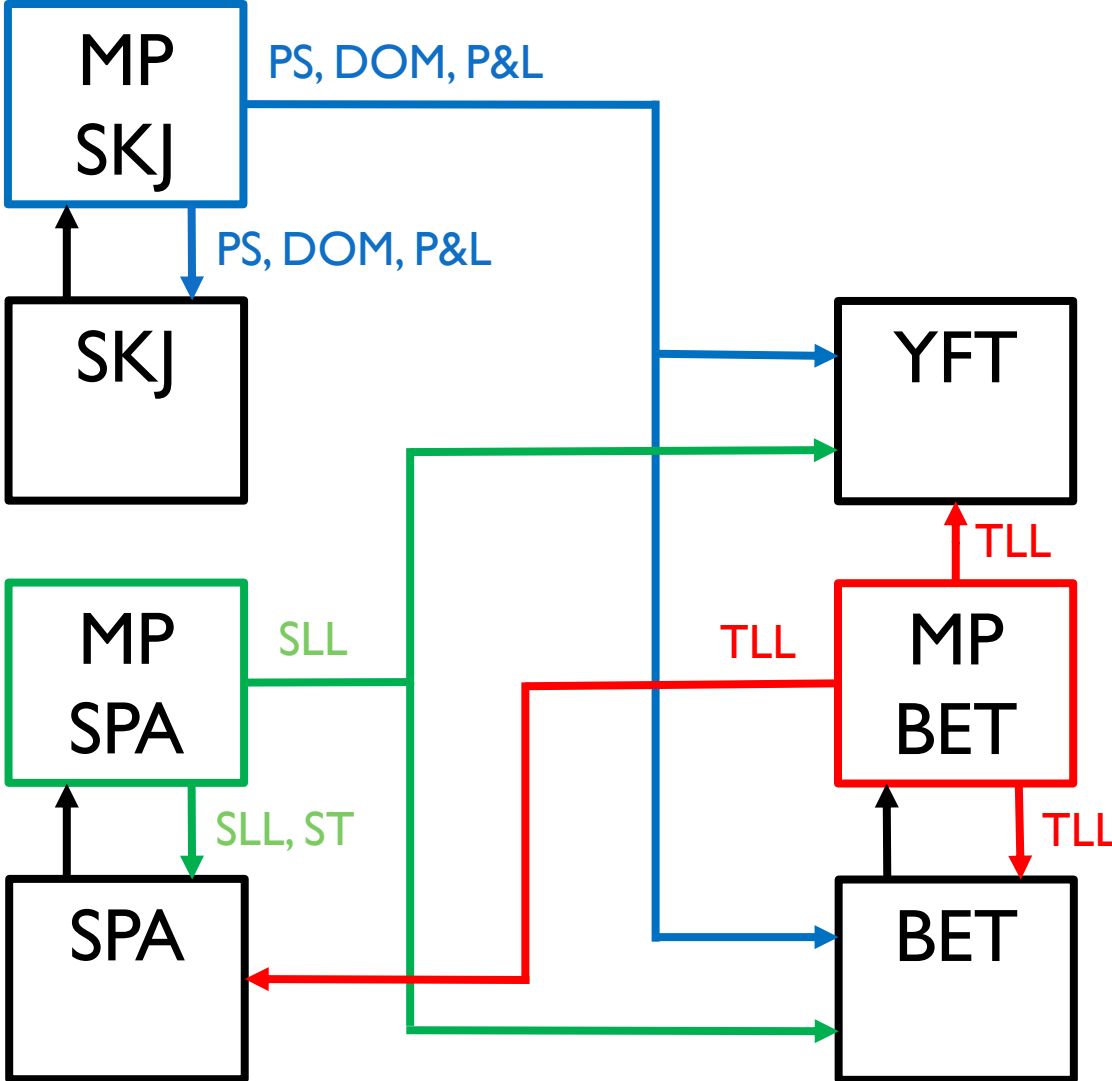
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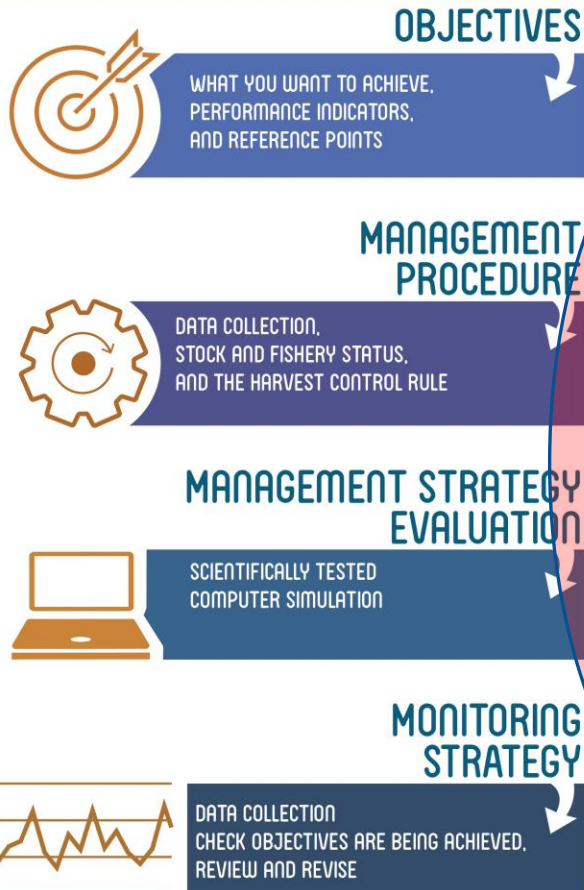
- Single stock management procedures.
- An MP can manage several fisheries, based on status of a single stock

FULL COMBINED MODELLING FRAMEWORK



Harvest strategies: The future of tuna fisheries management in the western and central Pacific

HARVEST STRATEGY



STAKEHOLDER DRIVEN
PRE-AGREED APPROACH

OBJECTIVE FOCUSED

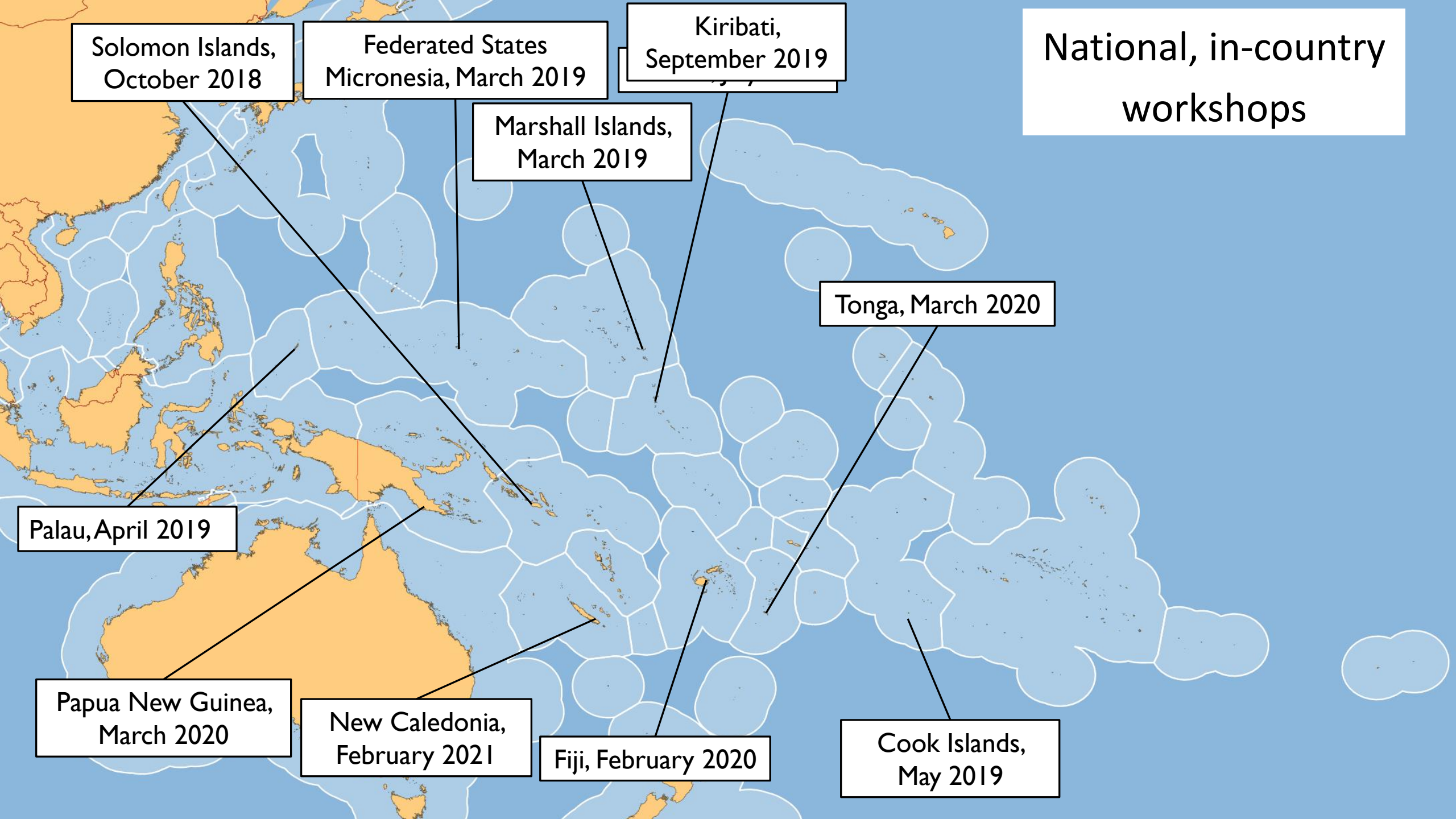
CERTAIN AND RESPONSIVE MANAGEMENT

HEALTHY TUNA STOCKS

PRODUCTIVE TUNA FISHERIES

BENEFITS

- Development driven by stakeholders
- Dialogue between scientists and stakeholders
- Harvest strategies are new to the region
- Strong requirement for capacity building and stakeholder engagement



Solomon Islands,
October 2018

Federated States
Micronesia, March 2019

Kiribati,
September 2019

Marshall Islands,
March 2019

Tonga, March 2020

Palau, April 2019

Papua New Guinea,
March 2020

New Caledonia,
February 2021

Fiji, February 2020

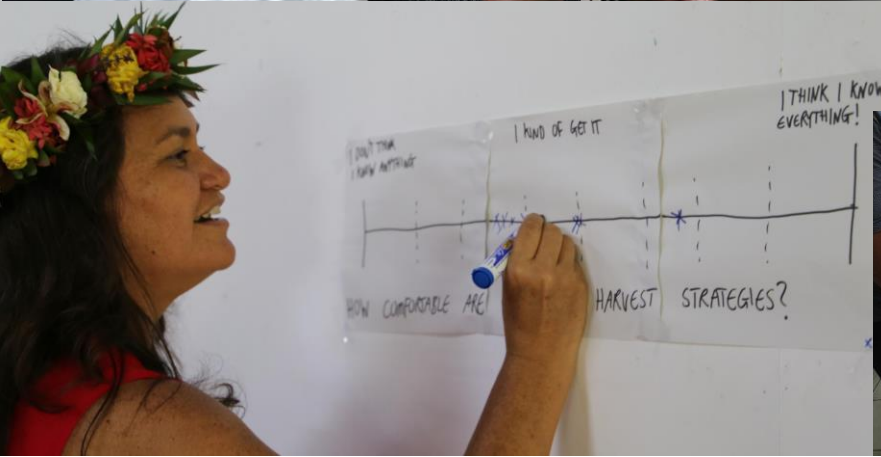
Cook Islands,
May 2019

National, in-country
workshops

National, in-country workshops

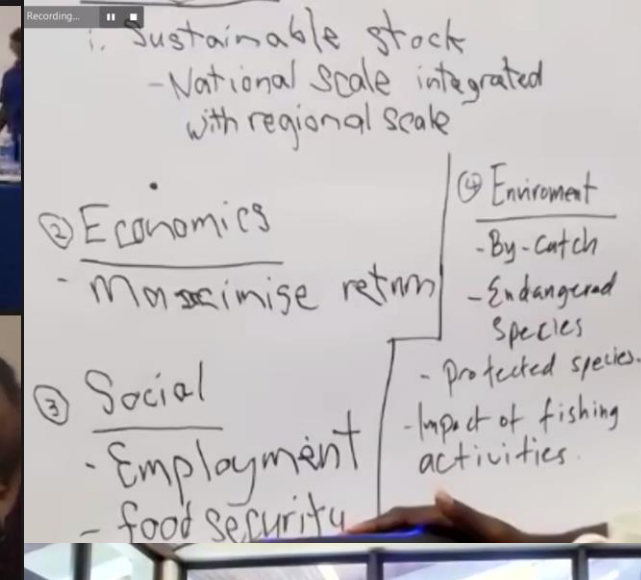


- Duration 2 – 3 days
- Day 1 – wider stakeholder group including industry reps, NGOs and staff from non-fishery departments
- Days 2-3 – staff from fishery departments
- Did not assume any specialist background knowledge
- Focused on interests and objectives of the country
- Mix of presentations, activities, discussions
- Feedback was gathered during and at the end, used to improve following workshops (e.g. Alice Chart)

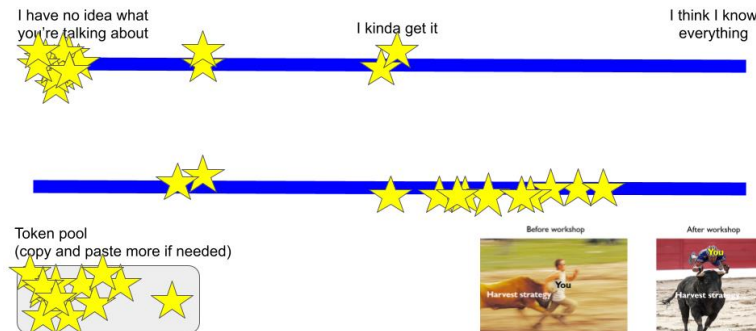


In 2020 moved to online workshops

- So far Tuvalu, Solomon Islands and Palau with French Polynesia, Samoa, Tokelau and Papua New Guinea booked for later
- More challenging
 - 3 half days
 - Difficult to read the room
 - Running activities (Conceptboard, Google Docs)
 - Internet is not always good
 - People are very bored of Zoom!
- Move back to in-country when travel resumes
- 260 people across all in-country and online workshops

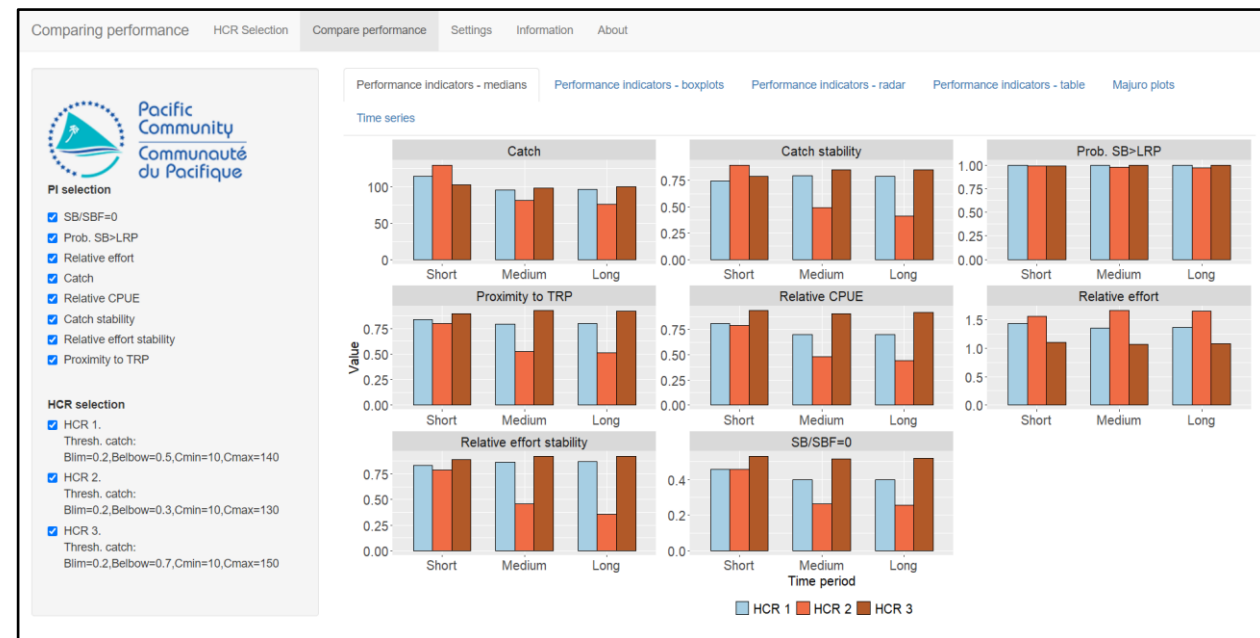
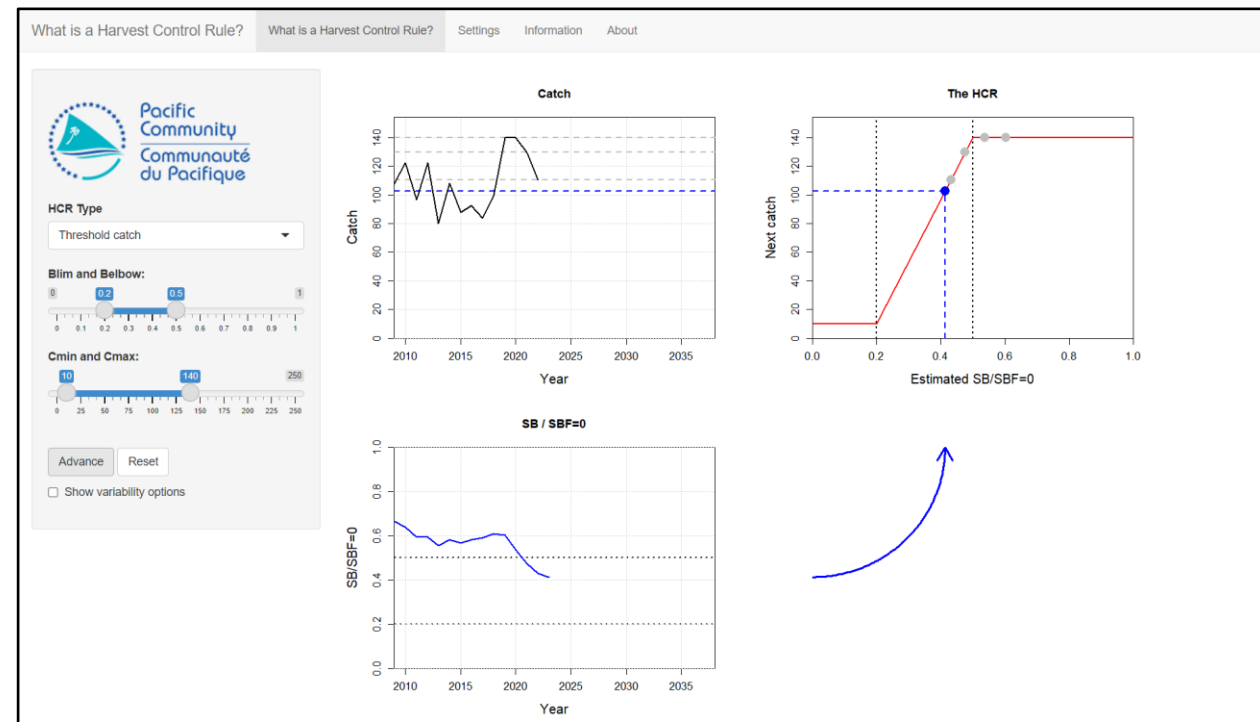


How comfortable are you with Harvest Strategies?

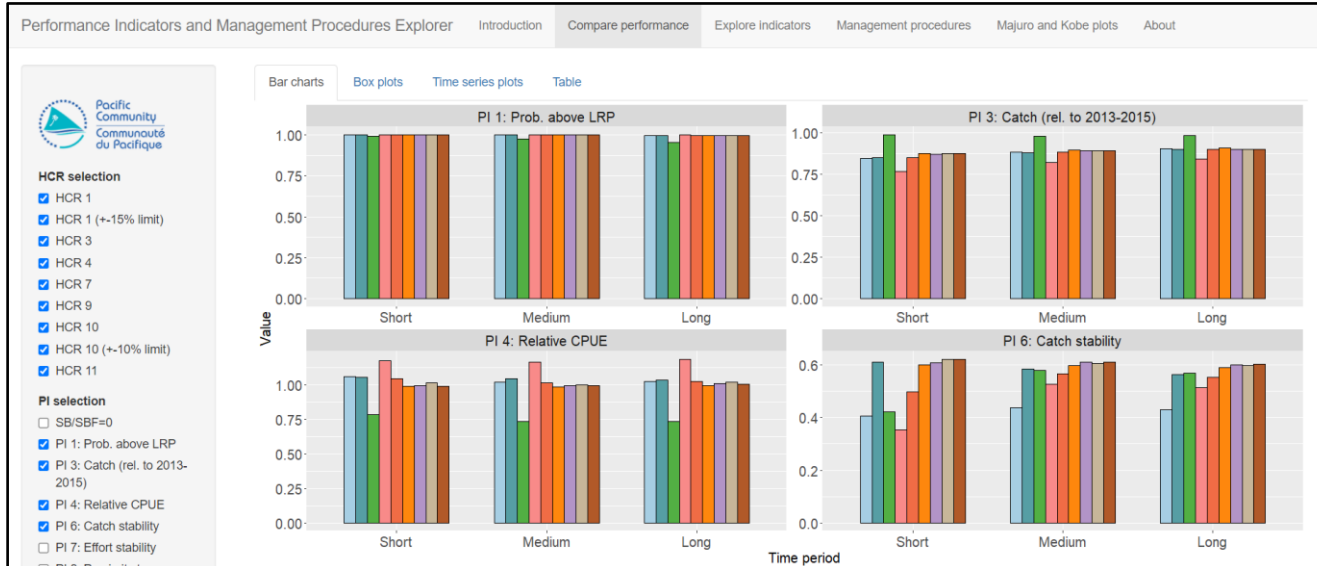


Interactive Training Tools: AMPED

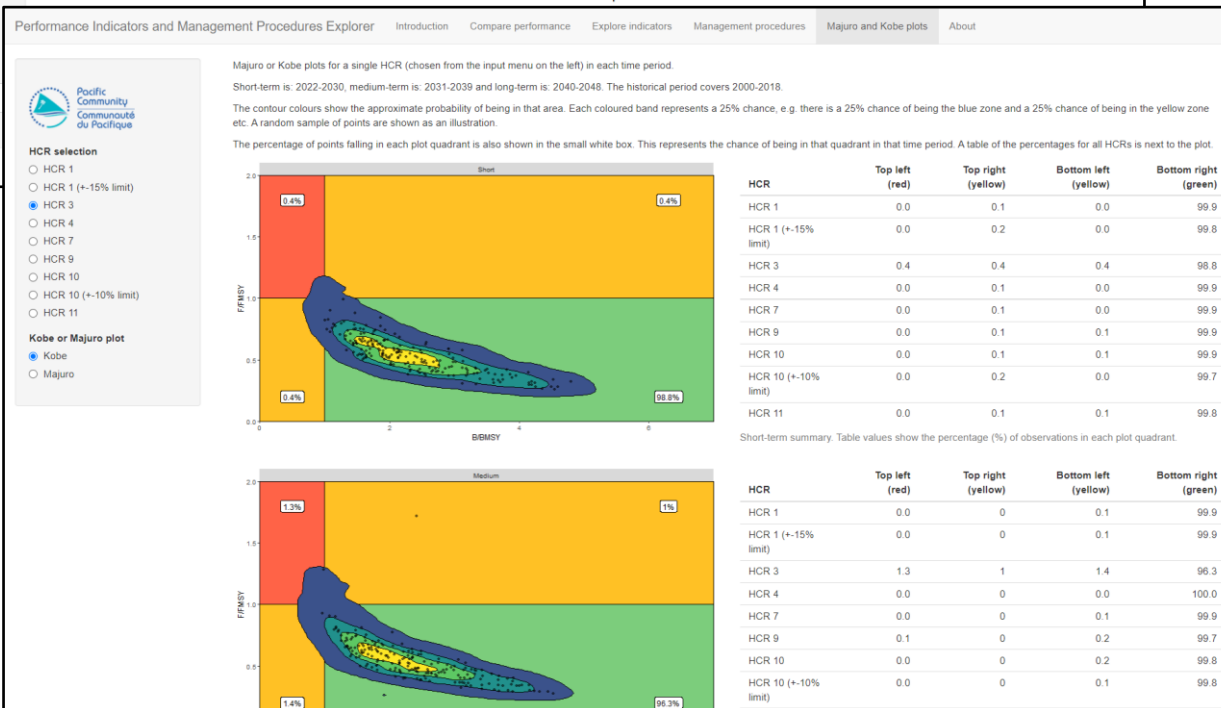
- R-Shiny apps
 - Introduction to HCRs
 - <https://ofp-sam.shinyapps.io/amped-intro-hcr/>
 - Introduction to indicators
 - <https://ofp-sam.shinyapps.io/amped-intro-indicators>
 - Comparing performance of HCRs
 - <https://ofp-sam.shinyapps.io/amped-comparing-performance/>
- Used in training workshops, including online.
- Self guiding tutorials also available to support learning outside of the workshop



Interactive Decision Making Tools



- Key decision: selection of preferred MP (HCR)
- Tool to compare performance of candidate skipjack MPs - **PIMPLE**
- <https://ofp-sam.shinyapps.io/pimple/>
- Drill down into the results, focus on indicators of interest, select preferred MP

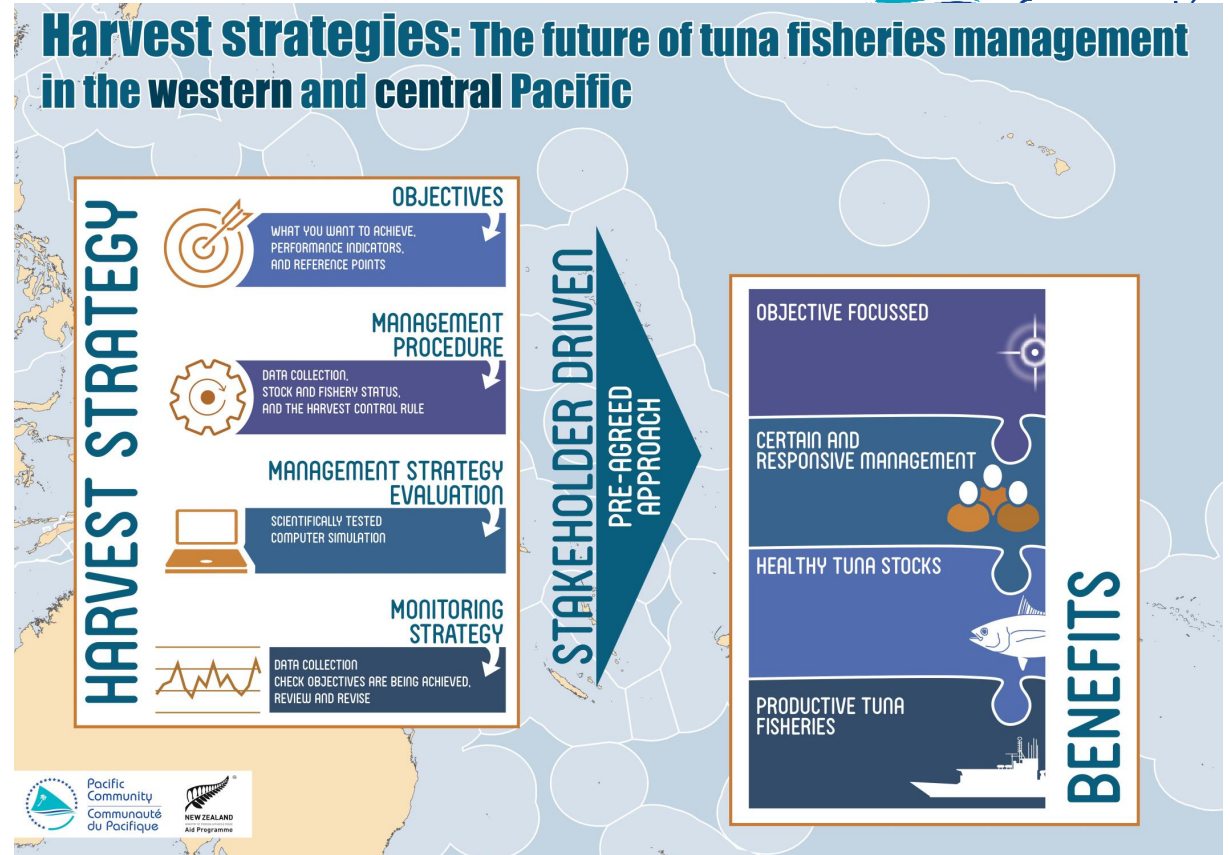


Additional engagement and capacity building



Introduction to Harvest Strategies

MOODLE: <https://spc.learnbook.com.au/my/>



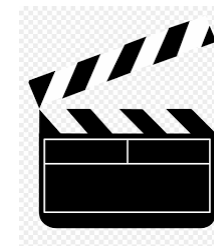
Poster distributed to regional fisheries departments



Pacific Islands Fisheries Professionals – one year placement at SPC (Jyanti Singh, 2020 - Fiji)

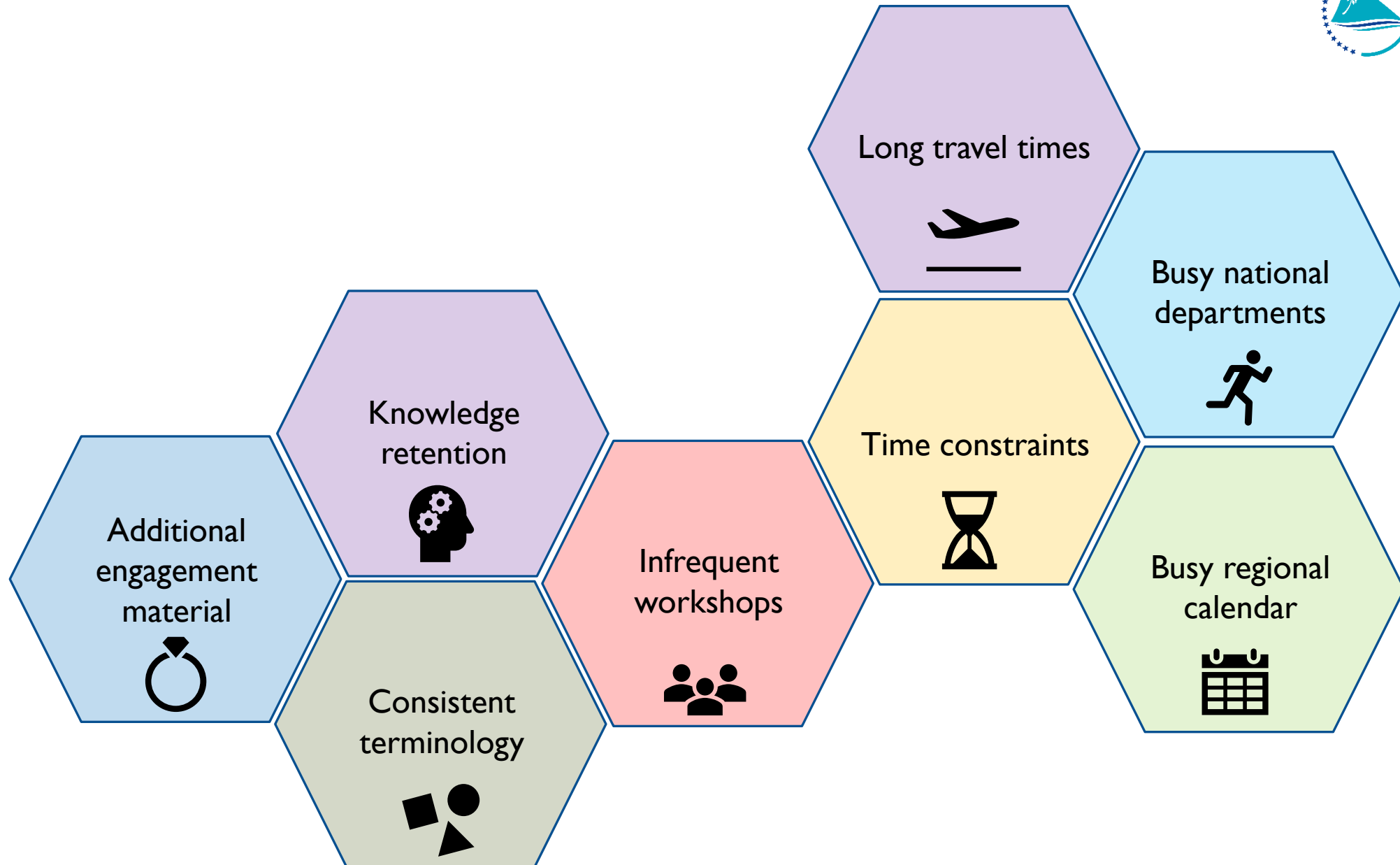


SLACK channel: #harvest-strategy-mse

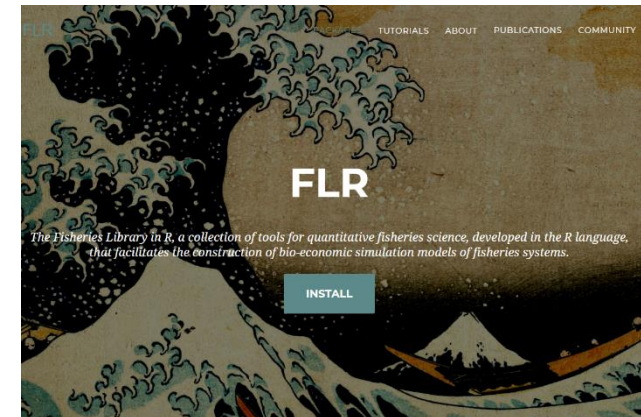


The harvest strategy film...

Engagement challenges



ACKNOWLEDGEMENTS

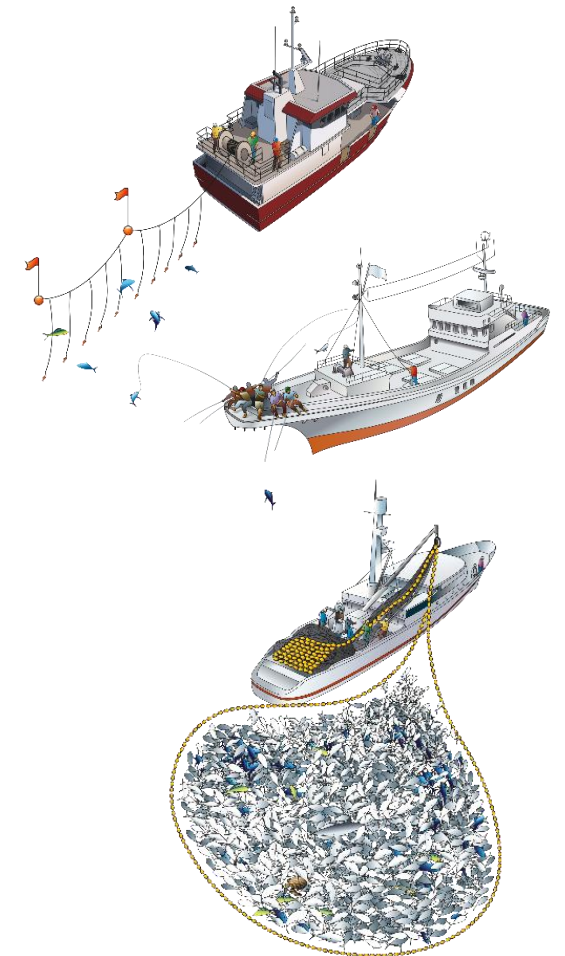




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MIXED FISHERIES APPROACH

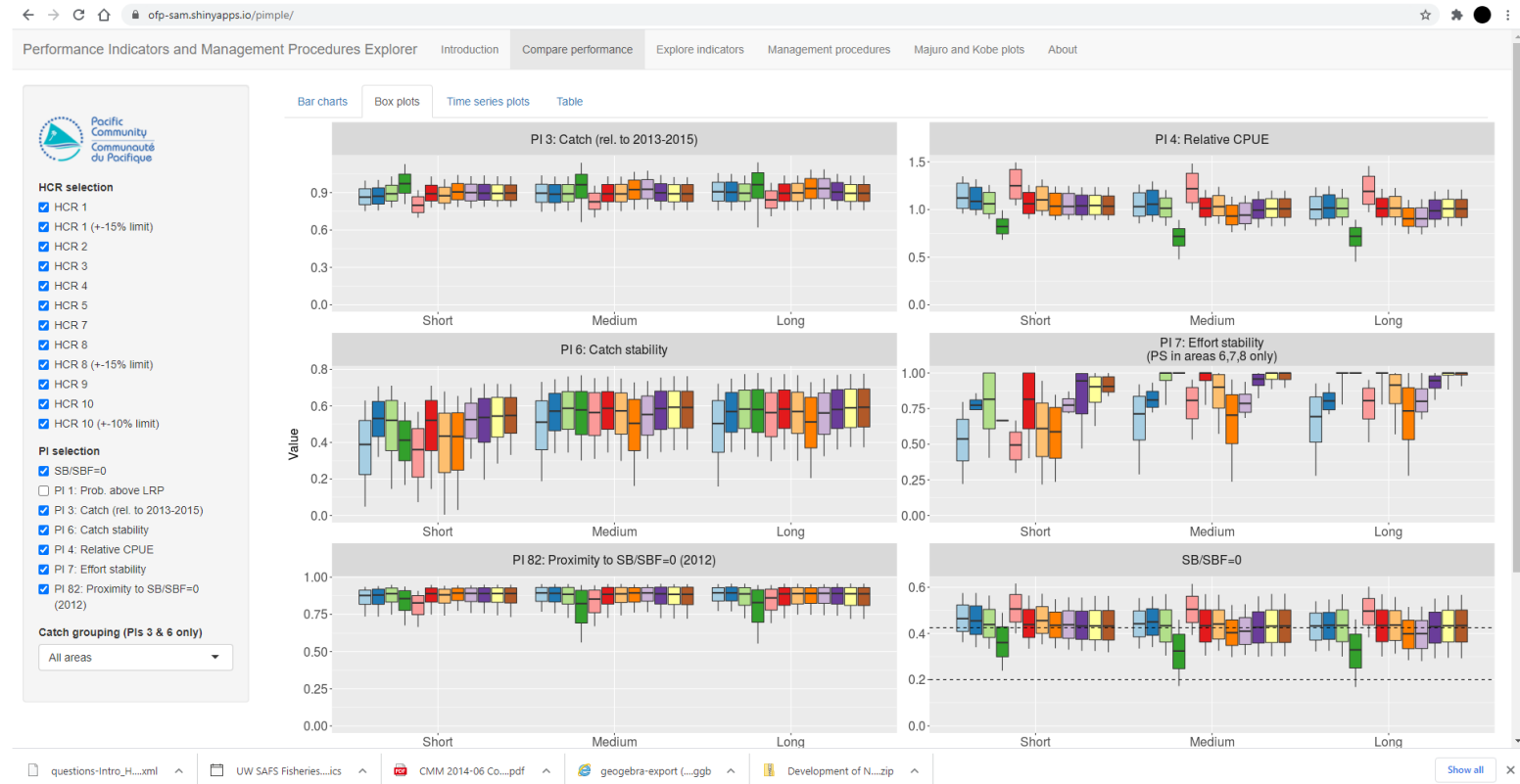
- SCI17-MI-WP-05
- First implementation of a reduced mixed fishery evaluation.
- Explores the impacts on BET and YFT of the SKJ management procedure.
 - Simple assumptions for BET
 - SP-Alb not included
- Outlines the procedure for transferring impacts between fisheries
 - Common unit – relative fishing effort
- Preliminary results promising
- Next steps
 - Fully specify **Operating Models** for BET and YFT
 - Develop **Management Procedures** for BET
 - Develop mixed fishery **Performance Indicators**



CAPACITY BUILDING

Workshops
Apps
Posters & Booklets
Videos

In person & online



SKIPJACK MSE – RESULTS

<https://ofp-sam.shinyapps.io/pimple>

