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Progress on the Development of Harvest Strategies for SP Albacore, Skipjack, Bigeye, and Yellowfin Tunas

WCPFC20-2023-14_Rev1[1]
31 October 2023

Prepared by the Secretariat and SPC

Introduction and Purpose

1. The purpose of this paper is to summarise the Commission's progress to date in developing harvest strategies for South Pacific albacore, skipjack, bigeye, and yellowfin tunas, and to provide information to support the Commission's discussions on harvest strategy work scheduled for review or adoption in 2023. This paper also provides information on the Commission's data collection and monitoring programmes that support harvest strategy work and other conservation and management measures for tuna stocks, with a view to identifying relevant 2024 tasks to the Scientific Committee (SC), Technical Compliance Committee (TCC), and the Scientific Services Provider (SSP). Discussions relating to updates to the harvest strategy workplan will be covered under Agenda Item 10.4.

2. The Commission's Harvest Strategy Work Plan was first adopted in 2015 to give effect to the requirements contained in paragraph 13[2] of CMM 2014-06 (now CMM 2022-03). As noted in the indicative Harvest Strategy Workplan adopted by WCPFC19, the workplan was always intended to be a living document, updated annually as progress on various harvest strategy elements was achieved. This approach has allowed the Commission to review its progress each year and plan future work, accordingly.

3. At its 19th regular session in 2022, the Commission extended the indicative Harvest Strategy Workplan for an additional two years until 2026. The harvest strategy CMM calls for the following elements to be contained in each harvest strategy, where possible:

    a. Management Objectives: Defined operational objectives, including timeframes, for the fishery or stock.
    b. Reference Points: Target and limit reference points for each stock (TRPs and LRPs).
    c. Acceptable Levels of Risk: Acceptable levels of risk of not breaching limit reference points.

[1] Updates to Table 1 (31 October 2023).

[2] 13. The Commission shall agree a workplan and indicative timeframes to adopt or refine harvest strategies for skipjack, bigeye, yellowfin, South Pacific albacore, Pacific bluefin and northern albacore[1] tuna by no later than the twelfth meeting of the Commission in 2015. This workplan will be subject to review in 2017. The Commission may agree timeframes to adopt harvest strategies for other fisheries or stocks.

d. Monitoring Strategy: A monitoring strategy using best available information to assess performance against objectives, including specified reference points.
e. Harvest Control Rules*: Decision rules that aim to achieve the target reference point and aim to avoid the limit reference point.
f. Management Strategy Evaluation (MSE): An evaluation of the performance of the proposed management procedure (including harvest control rule) against management objectives, including risk assessment.

**It is important to note the additional guidance from WCPFC19 contained in the indicative workplan, that the term "Management Procedure" is to be used in place of the term "Harvest Control Rule (HCR)" in the workplan, comprising a more formal specification of data collection, the associated estimation method together with a Harvest Control Rule.*

4. Progress achieved during 2015-2022 is summarised in **Table 1** with key reference papers, as noted in the table. **Table 2** provides a snapshot summary of progress towards implementing the harvest strategy elements for key WCPFC stocks and fisheries.

Table 1. A brief summary of key progress achieved in developing the WCPFC harvest strategy framework during 2015-2022. Source: WCPFC Harvest Strategy Workplan

Year	Progress Summary	Reference
2015	i. Agreed to harvest strategy workplan for the adoption of harvest strategies under CMM 2014-06 ii. The Commission adopted CMM 2015-06 establishing a TRP for skipjack tuna.	i. WCPFC12 Summary Report, Att Y ii. WCPFC12 Summary Report, Att G
2016	i. Agreed to determine the acceptability of potential HCRs where the estimated risk of breaching the LRP is between 0 and 20%. ii. Accepted the initial list of performance indicators for tropical purse seine fisheries for the purpose of the evaluation of harvest control rules iii. Agreed to a refined workplan for the adoption of harvest strategies under CMM 2014-06 iv. Agreed to an interim timeframe of up to ten years for rebuilding the bigeye tuna stock to the agreed Limit Reference Point of 0.2SBF=0	i. WCPFC13 Summary Report, Para 296 ii. WCPFC13 Summary Report Att M iii. WCPFC13 Summary Report Att N iv. WCPFC13 Summary Report, Para 305
2017	i. Noted candidate performance indicators for the Southern Longline Fishery and the Tropical Longline fishery to evaluate harvest control rules. ii. Agreed on actions to prioritise the development and adoption of a Target Reference Point for south Pacific albacore at WCPFC15. iii. Tasked the Secretariat to develop a dedicated space on the WCPFC website for publishing harvest strategies, including interim harvest strategies, agreed to by the Commission. iv. Agreed to reprioritise as needed the annual agenda of the Commission and Scientific Committee to allow sufficient additional time for consideration of harvest strategy issues. In addition WCPFC recognised that there may also be a need for a dedicated science/management dialogue.	i. WCPFC14 Summary Report, Attachment K, Table 1 and 2 ii. WCPFC14 Summary Report, Para 188 iii. WCPFC14 Summary Report, Para 208 iv. WCPFC14 Summary Report, Para 215

2018	i. Agreed to hold a 6-day annual meeting in 2019 with additional time devoted for the Commission to discuss harvest strategies. ii. adopted the Updated Workplan for the Adoption of Harvest Strategies under CMM 2014-06. iii. Agreed on an interim TRP for South Pacific albacore at $0.56SB_{F=0}$ with the objective of achieving an 8% increase in CPUE for the southern longline fishery as compared to 2013 levels. The TRP shall be reviewed every 3 years, consistent with the SP albacore assessment schedule, and the timeline for achieving the interim TRP shall be no later than 20 years.	i WCPFC15 Summary Report, Para 328 ii WCPFC15 Summary Report, Att. I iii WCPFC15 Summary Report, Para 207-212
2019	i. No need to review the Management Objectives on an annual basis. ii. Important to consider economic indicators based on economic and other data. iii. Agreed to progress work on a multispecies approach and to report back to the Commission. iv. Continue to build CCM's capacity on harvest strategies. v. Adopted the Updated Indicative Workplan for the Adoption of Harvest Strategies. vi. SC to provide advice on the formulation of TRPs for skipjack tuna and effort creep estimated in relation to the TRPs. vii. Revise WCPFC16-2019-15 (*Minimum TRPs for WCPO yellowfin and bigeye tuna consistent with alternative LRP risk levels, and multispecies implications*) using candidate revised interim skipjack TRPs of 42%,44%, 46%, 48% and 50% of SB/SBF=0. viii. Requested SC to provide advice on the formulation of TRPs for bigeye and yellowfin tuna for other candidate TRP indicators other than depletion ratio, such as longline CPUE. ix. Requested the SSP to conduct an analysis for bigeye and yellowfin tuna similar to that undertaken in WCPFC16-2019-14 (*Current and projected stock status of WCPO skipjack tuna to inform consideration of an updated target reference point*). x. Agreed that the interim paragraphs 12 and 14 of CMM 2018-01 be retained and tasked SC and SSP to explore potential candidate TRPs for the two stocks.	i. WCPFC16 Summary Report, Paragraph 170 ii. WCPFC16 Summary Report, Paragraph 181 iii. WCPFC16 Summary Report, Paragraph 195 iv. WCPFC16 Summary Report, Paragraph 207 v. WCPFC16 Summary Report, Att. H vi. WCPFC16 Summary Report, Paragraph 258 vii. WCPFC16 Summary Report, Paragraph 259 viii. WCPFC16 Summary Report, Paragraph 273 ix. WCPFC16 Summary Report, Paragraph 274 x. WCPFC16 Summary Report, Paragraph 275
2020	i. Requested SPC to update the skipjack TRP work by including additional candidates, including 36%, 38% and 40% in the median depletion table. ii. Noted the results of analyses on candidate TRPs for bigeye and yellowfin (WCPFC17-2020-12). * The SSP has made substantial technical progress during 2020, notably on MSE for South Pacific albacore and skipjack.	i. WCPFC17 Summary Report, Paragraph 159 ii. WCPFC17 Summary Report, Paragraph 165; WCPFC17-2020-12 (*SC16-requested analyses to inform WCPFC17 discussions on candidate target reference points for WCPO bigeye and yellowfin tuna*)

2021	i. Noted advice on possible formulations of a TRP for skipjack tuna. ii. Noted the results of analyses on candidate TRPs for bigeye and yellowfin. iii. Noted the importance of agreeing on TRP for bigeye and yellowfin and agreed to progress this work in 2022. iv. Agreed to defer consideration of MPs for skipjack until 2022. v. Noted the advice related to a recalibration of the interim TRP for the SP albacore. vi. Adopted the updated *Indicative Workplan for the Adoption of Harvest Strategies under CMM 2014-06*. vii. The Commission agreed to have the first Science-Management Dialogue, on a trial basis, back-to-back with SC18 in 2022, with a list of proposed areas of focus.	i. WCPFC18 Summary Report, Para 100 ii. WCPFC18 Summary Report, Para 107 iii. WCPFC18 Summary Report, Para 108 iv. WCPFC18 Summary Report, Para 111 v. WCPFC18 Summary Report, Para 171 vi. WCPFC18 Summary Report, Para 256; Att. I vii. WCPFC18 Summary Report, Para 271-272
2022	i. Noted the presentation on the TRP for skipjack tuna. ii. Adopted CMM 2022-01 *Conservation and Management Measure on a Management Procedure for WCPO Skipjack* Tuna iii. Noted TRPs for bigeye and yellowfin tuna, and agreed on the need for further work prior to considering TRPs for bigeye and yellowfin tuna. iv. Noted on South Pacific albacore objectives and the TRP. v. noted the additional work tasked by SMD01 to support decision-making on MPs for South Pacific albacore (WCPFC19-2022-16). *vi.* Adopted CMM 2022-03 *CMM on Establishing a Harvest Strategy for key fisheries and stocks in the WCPO.* *vii.* Adopted the updated *Indicative Workplan for the Adoption of Harvest Strategies under CMM 2014-06.* viii. Given the heavy workload in 2023, agreed not to hold an SMD in 2023 and agreed to assess the need to hold an SMD in 2024. * First Science Management Dialogue held in August 2022.	i. WCPFC19 Summary Report, Para 145 ii. WCPFC19 Summary Report, Para 152, Att. G iii. WCPFC19 Summary Report, Para 156; WCPFC19-2022-12 (*WCPO bigeye and yellowfin TRP evaluations (with updated 2022 skipjack assessment results*)) iv. WCPFC19 Summary Report, Para 212; WCPFC19-2022-15 (*Further analyses to inform discussions on South Pacific albacore objectives and the TRP*) v. WCPFC19 Summary Report, Para 222; WCPFC19-2022-16 (*Updates on MP evaluations for south Pacific albacore since SMD01*) vi. WCPFC19 Summary Report, Para 270; Att. L vii. WCPFC19 Summary Report, Para 277; Att. M viii. WCPFC19 Summary Report, Para 291 * SMD01 Outcomes Document: WCPFC19-2022-SMD01-01

Table 2. Summary of progress towards implementing the harvest strategy elements for key WCPFC stocks and fisheries.

Stock:	**Skipjack**	**SP Albacore**	**Bigeye**	**Yellowfin**
Gear:	*Trop. purse seine*	*Southern longline*	*Tropical longline*	
Management objectives	TRP adopted*	Noted	Noted	Noted
Management procedure	MP adopted*	Developing		
Performance indicators	Identified	Identified	Identified	Identified
Mixed fishery	Developing			
Monitoring strategy	Proposed#	Developing		

** CMM 2022-01 Conservation and Management Measure on a Management Procedure for WCPO Skipjack Tuna*

 # SC19-MI-WP-02Monitoring the WCPO skipjack management procedure

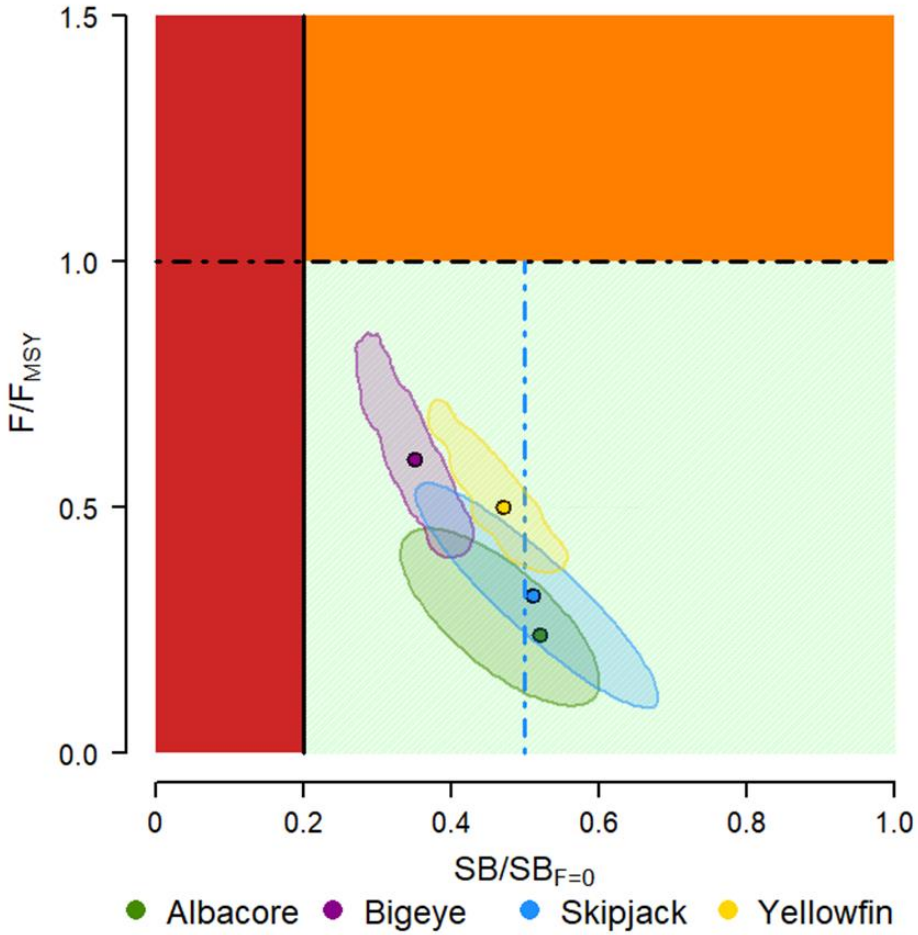


Figure 1. The Majuro plot depicts the biological stock status of each of the four tuna stocks covered in this paper. Stock status is presented in terms of spawning biomass depletion ($SB/SB_{F=0}$, a measure of the level of fishing impact on the adult stock, with a stock below 20% of unfished levels (the limit reference point) being defined as overfished) and F relative to F_{MSY} (a measure of fishing impact, with fishing mortality levels greater than F_{MSY} being defined as overfishing). Dots show the median estimates from assessment model grids for each stock. Ellipses represent the spread of values across the full grid of assessment models (note the irregular shapes for yellowfin and bigeye for the 2023 assessments of these stocks include estimation uncertainty). All four stocks are estimated to be within the green zone indicating they are not overfished and not subject to overfishing. **Table 3** provides the latest stock status information in greater detail for each of the four tuna stocks. This information is provided to inform discussions on harvest strategy elements under consideration at WCPFC20.

Table 3. Provision of scientific information on stock status and management advice after review of the Scientific Committee on the results of stock assessments for four key tuna stocks.

Stock status and trends	Management advice and implications
SP albacore tuna (SC17 stock assessment in 2021)	
The median value of relative recent (2016-2019) spawning biomass depletion for South Pacific albacore ($SB_{2016-2019}/SB_{F=0}$) was 0.52 with a 10^{th} to 90^{th} percentile interval of 0.41 to 0.57, with 0% probability that the recent (2016-2019) spawning biomass had breached the adopted LRP. There has been a long-term increase in fishing mortality for adult South Pacific albacore, with a notable steep increase in fishing mortality since 2000. The median of relative recent fishing mortality ($F_{2015-2018}/F_{MSY}$) was 0.24 with a 10^{th} to 90^{th} percentile interval of 0.15 to 0.37, with 0% probability that the recent (2015-2018) fishing mortality was above F_{MSY}. The results of stochastic projections from the 2021 assessment with fishing at "status quo" conditions (2017–2019 or 2020 average catch or, separately, fishing effort) show a steep and rapid decline in biomass towards the LRP in the year 2021 followed by an increase in biomass thereafter.	The spawning stock biomass has become more depleted across the model period (1960-2019), with a notable increase in depletion in the most recent years. The stock is not overfished, with zero estimated risk of the stock being below the LRP, however, the decline in the latest estimated $SB_{latest}/SB_{F=0}$ (year 2019; median 0.40; 10^{th} and 90^{th} percentiles 0.27 - 0.45) is notably more pessimistic than those of $SB_{recent}/SB_{F=0}$ (years 2016-2019; median 0.52; 10^{th} and 90^{th} percentiles 0.41 - 0.57) indicating that there has been a substantial decline in stock status estimated over the last three years. The median `latest' (2019) and `recent' (2016-2019) longline vulnerable biomass for the WCPFC-CA are 56% and 76% of the 2013+8% target level that defined the interim TRP, and CPUE declines in many domestic longline fisheries in the southern portion of the WCPFC-CA. Depletion is greatest in regions north of 25°S, where most domestic Pacific Island Countries and Territories (PICTs) fleets operate but unaffected by the current CMM 2015-02. Projections indicated that the stock has a greater than 20% risk of falling below the LRP in 2021 under both catch and effort scenarios and an extended period where biomass is below the current interim TRP and in most cases the TRP is not achieved within the 30-year projection period. Therefore, longline catch should be reduced to avoid further and extended declines in the vulnerable biomass so that economically viable catch rates can be maintained, especially for longline catch of adult albacore.

Skipjack tuna (SC18 stock assessment in 2022)	
The assessment grid of models estimated that the overall median recent spawning depletion ($SB_{recent}/SB_{F=0}$) is 0.51 (80^{th} percentile 0.43-0.64), which is close to the interim target reference point (TRP) of 0.50 (CMM 2021-01). No grid models were below the limit reference point (LRP) of 0.20 $SB_{F=0}$. The median of F_{recent}/F_{MSY} was 0.32 (80^{th} percentile 0.18-0.45). The 2022 stock assessment of skipjack tuna for the WCPO indicated that according to WCPFC reference points the stock is not overfished, nor undergoing overfishing. Fishing mortality continues to increase over time for the adult and juvenile components of the stock, with fishing mortality being consistently higher for adults. Fishery impact analyses show that the purse seine fisheries continue to dominate the impact in the equatorial regions 6, 7, and 8, with similar impacts by the 'associated' and 'unassociated' components, except for region 8 where 'associated' fishing appears to have more impact. Fishery impacts in region 5 are dominated by purse seine and other gears, and in regions 1-4, by pole-and-line, but with increasing impact of purse seine over time. The skipjack assessment continues to show that the stock is currently moderately exploited and the level of fishing mortality is sustainable. The skipjack stock is not overfished, nor subject to overfishing. At the same time, it was also noted that fishing mortality is continuously increasing for both adult and juvenile stages while the estimated spawning potential has shown a declining trend since the mid to late 2000s, and spawning potential depletion reached a historically low level in recent years.	In 2022, SC18 did not achieve a consensus on the management advice for skipjack tuna in the WCPO.

Bigeye tuna (SC19 stock assessment in 2023)	
The 2023 WCPO bigeye tuna stock assessment median depletion from the model grid for the recent period (2018-2021; $SB_{recent}/SB_{F=0}$) was 0.35 (10^{th} to 90^{th} percentile interval of 0.30 to 0.40, including estimation and structural uncertainty). For all models in the grid $SB_{recent}/SB_{F=0}$ was above the biomass limit reference point. The recent median fishing mortality (2017-2020; F_{recent}/F_{MSY}) was 0.59 (10^{th} to 90^{th} percentile interval of 0.46 to 0.74, including estimation and structural uncertainty). For all models in the grid, F_{recent}/F_{MSY} was less than one.	The objective for bigeye tuna in CMM 2021-01 (the Tropical Tuna Measure) – to maintain the spawning biomass depletion ratio at or above the average $SB/SB_{F=0}$ for 2012-2015 – is being achieved. $SB_{recent}/SB_{F=0}$ (35%) is very close to the average $SB/SB_{F=0}$ for 2012-2015 (34%) calculated across the unweighted grid. The stock is very likely not experiencing overfishing (100% probability $F_{recent}<F_{MSY}$) and is not in an overfished condition (0% probability $SB_{recent}/SB_{F=0}$<LRP). Fishery impact was higher in the tropical regions (Regions 3, 4, 7 and 8 in the stock assessment model), with particularly high fishing mortality on juvenile bigeye tuna in these regions. There is also evidence that the overall stock status is buffered with biomass and low exploitation in the temperate region (1, 2, 6 and 9) and most of the predicted movement is within the equatorial region. Exchange rates between temperate and tropical regions are estimated to be low. The reduction of fishing mortality on fisheries that take juveniles could increase bigeye fishery yields and reduce any further impacts on spawning biomass of this stock.
Yellowfin tuna (SC19 stock assessment in 2023)	
The 2023 WCPO yellowfin tuna stock assessment median depletion from the model grid for the recent period (2018–2021; $SB_{recent}/SB_{F=0}$) was estimated at 0.47 (10^{th} to 90^{th} percentile interval of 0.42 to 0.52, including estimation and structural uncertainty). For all models in the grid $SB_{recent}/SB_{F=0}$ was above the biomass limit reference point. The recent median fishing mortality (2017–2020; F_{recent}/F_{MSY}) was 0.50 (10^{th} to 90^{th} percentile interval of 0.41 to 0.62, including estimation and structural uncertainty).	The objective for yellowfin tuna in CMM 2021-01 (the Tropical Tuna Measure) to maintain the spawning biomass depletion ratio at or above the average $SB/SB_{F=0}$ for 2012-2015 is being achieved. $SB_{recent}/SB_{F=0}$ (47%) exceeds the average $SB/SB_{F=0}$ for 2012-2015 (44% calculated across the unweighted grid). The stock is not experiencing overfishing (100% probability $F_{recent}<F_{MSY}$) and is not in an overfished condition (0% probability $SB_{recent}/SB_{F=0}$<LRP). SC19 also noted a continuous downward trend in spawning potential ratio over the recent decade in Region 2 in the westernmost equatorial region,

For all models in the grid, F_{recent}/F_{MSY} was less than one.	mainly due to the miscellaneous gear fisheries within this region, whereas other regions have been relatively stable over this period. This is the impact of artisanal (small-scale) fisheries other than longline and purse seine within this region, and the Commission note the need for clear limits for these. There is evidence that the overall stock status is buffered with spawning biomass kept at a more elevated level overall by low exploitation in the temperate regions (1 and 5). The assessment model estimates spawning biomass to be divided between the tropical (59%) and temperate (41%) regions, but the vast majority of catch occurred in the tropical (94%) region.

Progress in 2023

5. Following the adoption at WCPFC19 of a Conservation and Management Measure on a Management Procedure (MP) for WCPO Skipjack Tuna (CMM 2022-01), the SSP ran the MP in 2023 for the first time. The output of the MP provides recommendations for the maximum 'overall' effort and catch levels for the WCPFC skipjack fisheries to apply for the next three years (i.e., 2024-2026).

6. Progress on harvest strategy development for south Pacific albacore, yellowfin, and bigeye tunas is occurring on technical areas related to developing and refining the Management Strategy Evaluation frameworks, and in the case of south Pacific albacore, beginning to develop and test candidate MPs. The mixed fishery modelling framework will develop further in 2024 based on the recently completed yellowfin and bigeye assessments. Formal TRPs for south Pacific albacore, yellowfin, and bigeye tuna are yet to be adopted by WCPFC. Interim objectives for yellowfin and bigeye are, however, noted in CMM 2021-01 which is considered under Agenda Item 10.2d.

7. The following sections summarise advice from SC19 and TCC19 in respect of harvest strategy elements for each of the four stocks, including the mixed fishery framework approach, to inform the Commission's discussions on those elements scheduled for adoption in 2023. Further details on SC19 and TCC19 outcomes can be found in the respective summary reports. All Recommendations noted in the following section are also included at the end of this paper in paragraphs 35-40.

South Pacific Albacore Tuna

8. The indicative harvest strategy workplan schedules the following harvest strategy elements for South Pacific (SP) albacore tuna for adoption in 2023:

2023	**Agree Target Reference Point (b)** Commission agree a TRP for South Pacific albacore **Develop management procedures (e)**

	and **Management strategy evaluation (f)** • SC agree the operating models for MSE. • SC provide advice on performance of candidate management procedures. • SC provides advice on relevant elements of the monitoring strategy (d).

9. SC19 **recommended** that WCPFC20 review the list of candidate TRPs outlined in **Table 4** when adopting a TRP for SP albacore and consider a TRP that is based on a set of reference years instead of a fixed value based on a biomass depletion percentage.[3]

Table 4[4]: Outcomes under alternative future combined longline and troll fishery catch levels (scalars) applied within the WCPFC Convention Area only. Outcomes are in terms of median (weighted) stock depletion level within the WCPFC-CA, risk relative to the LRP (WCPFC-CA specific), longline vulnerable biomass relative to alternative historical periods, and risk relative to the FMSY (South Pacific wide).

	Depletion			Vulnerable biomass		Approximate catch (mt)			F/FMSY
Scenario	Long-term avg. SB/SBF=0 (WCPFC-CA)	SB/SBF=0 rel. 2017-2019	Risk < LRP	VB rel. 2013 +8%	VB rel. 2017-2019	Catch scalar	WCPFC-CA	Remainder EPO	Risk F > FMSY
2 x SBMSY	0.32	-37%	38%	-53%	-36%	1.14	82,300	15,600	26%
SB/SBF=0 2019	0.39	-20%	28%	-43%	-21%	1.03	74,000	15,600	18%
	0.41	-17%	26%	-41%	-18%	1.00	72,200	15,600	17%
	0.47	-4%	19%	-33%	-7%	0.90	65,000	15,600	14%
SB/SBF=0 2017-19	0.49	0%	17%	-30%	-3%	0.86	62,500	15,600	12%
VB 2017-19	0.51	3%	16%	-28%	0%	0.84	60,500	15,600	12%
	0.53	8%	14%	-25%	4%	0.80	57,800	15,600	10%
SB/SBF=0 2015-18	0.58	18%	9%	-18%	14%	0.71	51,300	15,600	7%
	0.58	19%	8%	-18%	15%	0.70	50,500	15,600	6%
SB/SBF=0 2013	0.60	23%	6%	-15%	18%	0.66	47,800	15,600	5%
	0.64	30%	4%	-10%	25%	0.60	43,300	15,600	3%
	0.69	40%	1%	-3%	35%	0.50	36,100	15,600	0%

10. SC19 also reviewed a candidate operating model (OM) reference set to use for testing MPs to use for MSE of SP albacore. In light of the concerns about the suitability of the current OMs, it was suggested that the reference set be treated as interim, conditional on future investigations of OM specifications and the identification of additional OMs where relevant. SC19 supported the SSP's suggestion to expand the OM reference set to incorporate a scenario where the recent estimated 'recruitment dip[5]' was less pronounced.

[3] See SC19 Outcomes Document paragraphs 147 – 154.

[4] Table 1 in SC19-MI-WP-03

[5] Long-term historical estimated trends indicate progressively increasing recruitment from around 1980 to 2010 with a marked dip in recent years (Figure 2). The true extent of this dip is unclear (see Scott (2023). Under current model settings the dip has a substantial yet transitory impact on predicted levels of population abundance. (Refer to Figure 2, SC19-MI-WP-04)

11. Therefore, SC19 **recommended** the use and development of a reference OM set shown below in **Table 5**[6] [7] over the next year to allow the continued progress and evaluation of candidate MPs for SP albacore.

Table 5: SP albacore OM uncertainty grid. Scenarios shown in bold are proposed for the reference set. ‡ denotes those scenarios for which a dedicated fit of MULTIFAN-CL is required.

Axis	Levels		Options		
	Reference	Robustness	0	1	2
Process Error					
Rectmnt Variability	1		1960-2017		
Observation Error					
Catch and effort	1		25%		
Model Error					
Steepness ‡	3		0.65	0.8	0.95
Movement ‡	2		Estimated	SEAPODYM	
Growth ‡	2		Estimated	fixed, Chen-Wells	
Size comp. wtg ‡	3		50 (low)	25 (medium)	10 (high)
Rectmnt distbn	2		SEAPODYM	Regions 3 & 4	
Implementation Error					
Longline effort creep	2		0%	2%	

12. SC19 reviewed an update on the progress of developing and testing MPs for SP albacore, including estimation model options, HCR designs, and preliminary evaluations and consideration of performance indicators, and supported the use of the age-structured surplus production model (ASPM) as the estimation model and a 3-year cycle for MP update consistent with the stock assessment cycle for SP albacore tuna.

13. SC19 **recommended** that WCPFC20 review the current set of 6 candidate MPs based on four different candidate HCRs in **Figure 1** for initial consideration, noting the diverse range of MP configurations provided by the SSP is sufficient to support discussions on desirable features and design priorities:

    i. (1) HCR 1
    ii. (2) HCR 1 (+/- 10% limit)
    iii. (3) HCR 1 (+/- 5% limit)
    iv. (4) HCR 2 (+/- 10% limit)
    v. (5) HCR 3 (+/- 10% limit)
    vi. (6) HCR 4 (+/- 10% limit)

[6] See SC19 Outcomes Document paragraphs 155 – 165.
[7] Table 1 of SC19-MI-WP-04

SC19 paper SC19-MI-WP-06 "Evaluation of candidate management procedures for South Pacific albacore (27July2023) - Rev.01" provides further details on the evaluations of candidate MPs for SP albacore.

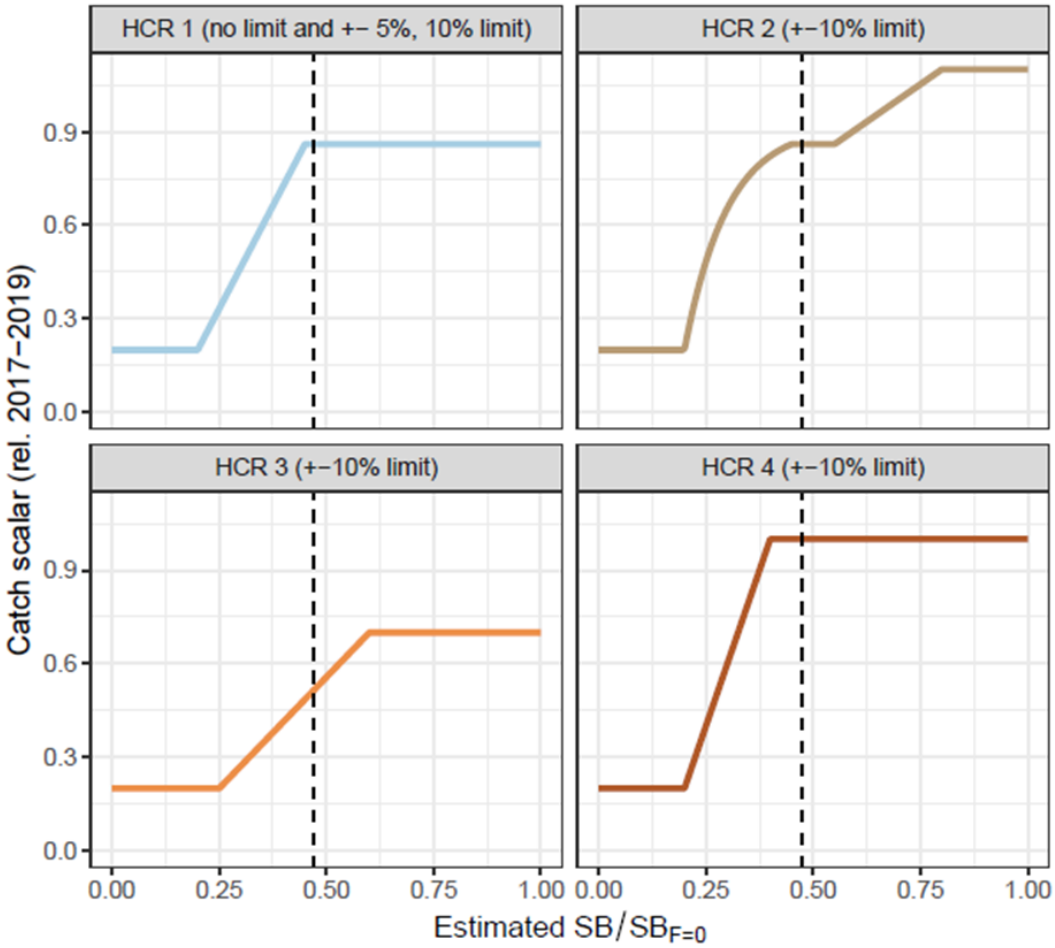


Figure 2: Shapes of the harvest control rules (HCRs) in the candidate management procedures. Note that there are three versions of HCR 1 with differing levels of catch constraint (no limit, 5 and 10%).

14. SC19 further **recommended** that the Commission provide guidance based on these exploratory MPs on features to be further developed by the SSP, including performance indicators, controlled fisheries and control mechanisms, and HCR shape and design.[8] The points listed in Box 1 are offered to assist the Commission's development of guidance on the above harvest strategy elements.

[8] See SC19 Outcomes Document paragraphs 166 – 182.

Box 1.

HCR design:

i. What is the appropriate value for the TRP, taking into account medium- and long-term objectives?
ii. How will those objectives be achieved, i.e. how much can catch or effort change from one period to the next.

MP design:

iii. Inclusion/exclusion of the troll fishery can be incorporated, subject to a decision on this.
iv. Scenarios for the EPO should be developed.
v. Control mechanisms can be a mixture of catch and effort (similar to the SKJ MP) but some guidance on which fisheries to control by which mechanism would be required.

Performance indicators:

vi. Some main indicators could be total catch, catch rate (CPUE), relative catch stability, and risk of falling below the LRP.
vii. What other performance indicators might be required from MP evaluations?

Skipjack Tuna

15. The indicative harvest strategy workplan schedules the following harvest strategy elements for skipjack tuna for adoption in 2023:

2023	[SC consider multispecies aspects of WCPO harvest strategies and implications for the monitoring strategy] **SC provide advice on relevant elements of the monitoring strategy (d)**

16. As called for in CMM 2022-01, the SSP ran the skipjack MP in 2023 and SC19 reviewed the output contained in SC19-MI-WP-01 (WCPO skipjack management procedure). SC19 noted that the estimation method ran successfully and returned an estimate of $SB_{latest}/SB_{F=0}$ of 0.42, and that the corresponding scalar from the HCR was 1.0.[9]

17. In other words, the estimation model ran successfully and with model diagnostics showing good model performance. The estimation model returned an estimate of spawning potential depletion ($SB_{latest}/SB_{F=0}$) in the terminal year (2022) of 0.42, which corresponds closely to the predicted outcome from the MP evaluations (**Figure 2**). According to the agreed HCR in CMM 2022-01, a depletion level of 0.42 corresponds to a scalar of 1.0 which means that the management recommendation for three years (2024-2026) is to set maximum fishing levels at the baseline conditions, i.e., 1) effort in the purse seine fisheries to 2012 levels; 2) effort in pole-and-line fisheries to average 2001-04 levels and 3) catch in the domestic fisheries of assessment region 5 to average 2016-18 levels.

[9] See SC19 Outcomes Document paragraphs 129 – 136.

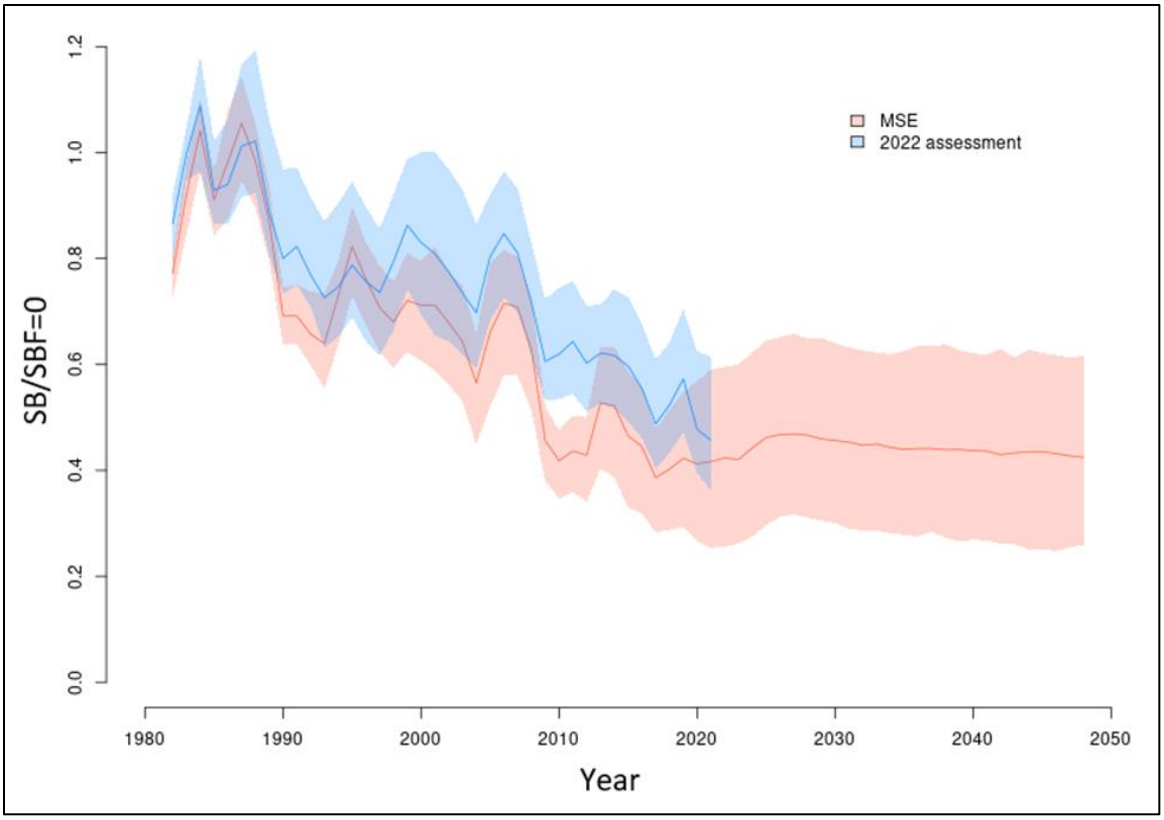


Figure 3: Distribution of predicted spawning potential depletion ($SB_{latest}/SB_{F=0}$) for the MSE evaluation of the WCPFC19 adopted MP and the estimated $SB_{latest}/SB_{F=0}$ from the 2022 stock assessment. Solid red and blue lines represent median $SB_{latest}/SB_{F=0}$ determined by the MSE and the 2022 stock assessment respectively.

18. SC19 **recommended** that the Commission take into consideration the successful running of the skipjack MP as outlined in SC19-MI-WP-01 and its output, which indicates that maximum effort in the purse seine and pole-and-line fisheries and maximum catches in all other fisheries should be set to their respective baseline levels (specified in CMM 2022-01) for the period 2024-2026, when implementing CMM 2022-01, as follows:

    - Purse seine: 2012 effort levels
    - Pole and line: 2001-04 effort levels
    - Region 5[10] domestic fisheries: average 2016-18 catch levels

19. Noting that with maximum effort and catches now recommended by the MP for respective fisheries for the next three years and the opportunity it provides for further work, SC19 also **recommended** that a re-evaluation of the skipjack estimation method needs to be undertaken prior to the next implementation of the MP.

20. A key element of the skipjack harvest strategy is a monitoring strategy,[11] which uses the best available data and information to routinely assess the MP's performance against agreed reference points. The monitoring strategy should consider all aspects of the harvest strategy, including:

[10] Region 5 is the western equatorial regions between 20°S to 20°N and from 110°E to 140°E (including Indonesia, Philippines and Vietnam fishing area) but excludes a 10°x10° area from the northeast corner.
[11] See SC19 Outcomes Document 137 – 146.

- procedures for evaluating and testing the MPs,
- the scenarios that should be included in the OM grid,
- the preparation and application of the estimation method, and
- the performance of the management procedure as a whole.

In addition, it may identify changes in the dynamics of the fishery resulting from environmental, economic, or social factors that may require a reconsideration of the management objectives and the testing of alternative MPs.

21. In an effort to simplify and streamline the monitoring process for the Commission and its subsidiary bodies, SC19 supported the compiling of a summary monitoring report contained in **Attachment A**[12], consisting of a summary table that identifies the elements of the monitoring programme that may require additional work or through which major problems may be identified.

22. SC19 also noted that the annual review of each element of the monitoring strategy will provide an opportunity for the Commission and its relevant subsidiary bodies[13] to review, and where necessary (depending on the degree of impact on the MP), update the management objectives to ensure the overall harvest strategy remains appropriate as the nature of the fishery evolves over time. SC19 further noted that development and implementation of a monitoring strategy would likely be an iterative process with some time-lags before each body will be able to fulfil some of its roles.

23. At SC19's request, TCC19 reviewed the draft monitoring report and adopted the following outcome: "*TCC19 noted the proposal by some CCMs on amending the SKJ management procedure monitoring report. SC19 indicated that TCC may have a role to play in fisheries monitoring and data collection as captured in SC19-MI-WP-02. TCC19 referred the proposal to WCPFC20 for guidance on what the technical contribution that TCC is expected to contribute to the SKJ management procedure monitoring process*."

24. SC and TCC each noted the need for further guidance from the Commission on their respective roles in developing and implementing a monitoring strategy for skipjack tuna. Attachment B provides additional information to support the Commission's consideration on this issue.

Bigeye and Yellowfin Tuna

25. The indicative harvest strategy workplan schedules the harvest strategy elements for bigeye and yellowfin tuna in 2023, as follows:

2023	**Develop management procedures (e)** and **Management strategy evaluation (f)** [Continue development of multispecies framework] • SC provide advice on performance of potential management procedures. • Commission consider advice on progress towards management procedures. [Updated stock assessment considered by SC19]

26. SC19 did not consider any new information relating to the harvest strategy elements for bigeye and yellowfin tuna in 2023.

[12] SC19-MI-WP-02 (Monitoring the WCPO skipjack management procedure)

[13] FAC will also have a role in considering elements of the monitoring strategy that will require funding.

27. For bigeye tuna, the current status of harvest strategy development is summarised as follows:

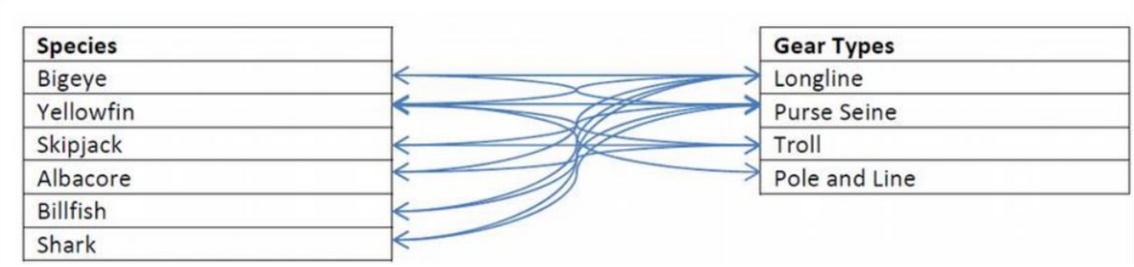
- Develop operating models following the latest stock assessment, which will be presented to SC20;
- Work has started on developing estimation methods as part of the MP to be presented to SC20;
- Revise MSE framework following operating models, which will be used to test candidate MPs and present to SC20, and;
- Investigate TRP options using MSE framework.

28. For yellowfin tuna, the current status can be summarised as follows:

- Develop operating models following the latest stock assessment, which will be presented to SC20;
- Revise MSE framework following the operating models, which will be used to test evaluate impact of SKJ and BET MPs and present to SC20, and;
- Investigate TRP options using MSE framework.

Mixed fisheries MSE framework

29. It is important that the Commission's Harvest Strategy Approach takes into consideration that there are mixed fishery interactions because the four key tuna species are caught by an overlapping mix of fisheries with different gears in overlapping regions. This means that management measures aimed at one stock can have impacts on other stocks, and a management procedure which manages several fisheries, but which is based on the status of a single stock will have impacts on other management procedures. For example, in the tropical region there are fishery interactions between longline and purse seine fisheries, and tropical tuna longline fishery management measures will necessarily overlap with southern longline measures for south Pacific albacore tuna.



Source: Trade-offs in Multispecies, Multi-gear fisheries: Second expert working group on Management Objectives. Norris et al (2013).

30. In considering SC15's advice in 2019, the Commission agreed to a hierarchical approach to harvest strategy development, based on a collection of single species models. Under this approach, MPs would be developed for skipjack, south Pacific albacore, and bigeye tuna. Yellowfin tuna would not have a dedicated species-based MP. Rather, the impact on yellowfin tuna would be evaluated from the application of the combined MPs for skipjack, bigeye and South Pacific albacore to all fisheries that significantly impact yellowfin. This framework would be used to identify those MP combinations that have an acceptably high probability of achieving management objectives for all stocks, including yellowfin.

31. This approach allows the development of harvest strategies for skipjack and South Pacific albacore tuna to proceed initially as single species approaches that can subsequently be incorporated into a mixed fishery and multi-species framework that includes bigeye and yellowfin tuna as well as other relevant stocks and fisheries. Given the overlapping mix of fisheries in the WCPO, the mixed fishery framework allows for investigation of the implications of MPs for one stock on each of the other stocks.

32. Potential challenges that have been noted with this approach include: (1) the possible requirement for the inclusion of performance indicators from interacting stocks/fisheries when developing MPs for any single species; (2) the possible need to prioritise the management of particular stocks or fisheries to avoid stock collapse, and; (3) the potential for target switching and resource substitution if one or more stocks are left unregulated. The details and practical implementation of the hierarchical approach have yet to be fully developed, and hence further time will be needed for this element of the work plan.

33. While the proposed hierarchical approach would not fully capture mixed fishery/mixed species interactions in an integrated framework (which would require multi-species MPs), it provides a staged approach for developing fishery-based harvest strategies from a collection of single species modelling frameworks. If the approach suggests that these are not well managed under the current mixed fishery framework, then another approach will be needed.

34. SC19 reviewed updates from the SSP on the development of the mixed fishery MSE framework and recommended that WCPFC20 take note of the progress to date and provide feedback.[14]

[14] See SC19 Outcomes Document paragraph 190.

Data Collection and Monitoring to Support Harvest Strategies

Table 6 sets out the Commission's data collection and monitoring tools currently in place or under development to support WCPFC conservation and management measures, including harvest strategy elements. This information is provided to support management discussions by identifying ongoing work or gaps that require attention by the Commission and/or its relevant subsidiary bodies.

Table 6.

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
Data requirements for stock assessment and estimation models used in monitoring strategies	Catch and Effort data – logbook Regional Observer Programme (ROP) data Discard data Species composition data WCPFC Tuna Assessment Research Plan (TARP) for 'key' tuna species assessments in the WCPO	There are few data gaps in WCPFC Scientific Data submissions by all CCMs, which provides annual catch estimates, aggregated and operational-level catch and effort data and size composition data. The data provided by the Regional Observer Programme comes from 100% coverage in purse seine fisheries, and a minimum of 5% coverage rate in other fisheries. Tuna tagging data remains an important data source to support stock assessment work, and this work depends on WCPFCs annual contribution to the Pacific Tuna Tagging Programme. Age, growth, maturity and population structure information are additional data sources that inform stock assessments – the prioritisation of this work, the workplan of activities, and indications on what is funded and unfunded by WCPFC are described in the TARP.	TCC19-2023-IP03 Scientific data available to the WCPFC TCC19-2023-IP04 Tables of coverage levels for operational data fields submitted to the WCPFC TCC19-2023-IP02 Status of Observer Data Management ERandEMWG4-2020-04 Outcomes of the review of the Commission's data needs and collection programmes (SC Project 93) SC19-RP-PTTP-02 Report of the Pacific Tuna Tagging Programme Steering Committee (Project 42) SC19-SA-WP15 Tuna Assessment Research Plan (TARP) 2023-2026
Data requirements for potential performance indicators used in monitoring strategies	Regional Observer Programme (ROP) data Discard data	Current focus of IWG-ROP is to refine data fields collected by ROP observers. Increasing observer coverage rates in non-purse seine fisheries remains important to improving the Commission's data collection, particularly	IWG-ROP workplan 2023 - 2025 ERandEM WG Update

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
	Species composition data Electronic Monitoring Cannery/Processor Data Market /Trade Data Economic Data Social Data	related to discards, species composition and impacts of fishing activities including on bycatch and non-target species. Ultimately the aim is to strengthen the Commissions management framework. Current focus of ERandEMWG is to establish Electronic monitoring (EM) In 2021, the Commission adopted guidelines for the voluntary submission of purse seine processor data by CCMs to the Commission. Current focus of SC Project 114 is to improve the coverage of cannery receipt data because although there is 100% observer coverage, in practice ~0.1% of catch can be sampled for species composition and purse seine processor (cannery) data provide a potentially important data source for verifying estimates of pures seine tuna species catches. Economic and social data is needed to develop performance indicators (PIs) that would help SIDS measure the economic effects of WCPFC management measures on their fisheries, and for assessment of multispecies management procedures.	Guidelines for the Voluntary Submission of Purse seine Processor data by CCMs to the Commission SC19 Summary Report – Data and Statistics Theme and Proposed work programme and budget (for Project status)
Days fished fishery limits [purse seine]	Pacific Vessel Monitoring System (VMS) Record of Fishing Vessels FFA Good Standing data	There is high confidence in the report that SPC regularly compiles for WCPFC because coverage of purse seine fishery operational catch and effort data is 100% for most purse seine fleets. With a 100% purse seine observer coverage requirement, there is high coverage of observer data for the purse seine fishery and VMS data through the Pacific VMS (WCPFC VMS + FFA VMS data combined) is also has high	TCC19-2023-11 Available data for verifying compliance in the CMS

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
	And data collection and monitoring programmes supporting stock assessment and estimation models, to check that management objectives are being met	coverage. The Pacific VMS provides 100% coverage of high seas purse seine fishing activities, and nearly 100% in EEZ waters (there are some VMS data gaps for purse seine activities in non-SPC member waters). The current data collection and monitoring programmes provide data from multiple sources that can be used to verify CCMs implementation of purse seine days fished implementation.	
Vessel capacity/number limits [by vessel type]	Record of Fishing Vessels Pacific Vessel Monitoring System (VMS) FFA Good Standing data *And data collection and monitoring programmes supporting stock assessment and estimation models, to check that management objectives are being met* *And Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives*	The vessel number limits for most CCMs have been notified and are published as numbers on the CMM page on the website. The Secretariat does not presently receive from the flag CCMs a reference list of the vessels used to determine the baseline, nor does the Secretariat receive in the report from flag CCMs, the list of the vessels that the flag CCM considers to be currently covered by the scope of the relevant vessel capacity limit at any point in time. Evaluations of CCMs' self-reported information are currently compared to available RFV and VMS data. For purse seine capacity limits, the FFA good Standing register data provides slightly higher confidence in the evaluation of CCM-reported information. The current data collection and monitoring programmes partially verify purse seine capacity limits. For HSP1 capacity limits for Philippines, the manual entry and exit reporting, analysed with VMS data, provides slightly higher confidence in the evaluation of CCM-reported information.	TCC19-2023-11 Available data for verifying compliance in the CMS WCPFC20-2023-33 Chair's Consultative Draft for a Revised Tropical Tuna Measure

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
		The current data collection and monitoring programmes partially verify HSP1 capacity limits. For longline capacity limits there is limited data from current data collection and monitoring programmes data to verify compliance, so evaluations of limits are self-reported. To improve the level of independent verification of longline catch or effort limits, it is necessary to increase ROP observer coverage and to enable use of Electronic Monitoring so as to increase the scope and coverage, and thus the availability, of independently collected data Chairs consultative draft for TTM CMM includes proposals to establish additional MCS measures for longline fisheries, including 30% ROP longline observer coverage, entry and exit reporting for high seas of the Convention Area to support verification of longline vessels that are active in the Convention Area.	
Target species Catch Limits [size?]	Record of Fishing Vessels Pacific Vessel Monitoring System (VMS) Regional Observer Programme Electronic Monitoring *And data collection and monitoring programmes supporting stock assessment and estimation models, to check that management objectives are being met*	For catch-based limits, there is limited data available from current data collection and monitoring programmes data to verify compliance with CCMs limits. The current approach used in the dCMR compares CCMs self-reported information to the ACE tables data, which are published summaries based on CCMs Scientific Data Submissions. For longline fisheries limits, the evaluation is self-reported, because the minimum 5% ROP observer coverage requirement means that	TCC19-2023-11 Available data for verifying compliance in the CMS WCPFC20-2023-33 Chair's Consultative Draft for a Revised Tropical Tuna Measure

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
	Port Sampling Transhipment reporting Catch Documentation Scheme *And Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives*	there is limited data to independently verify reported catch and effort data submissions. Chairs consultative draft for TTM CMM includes proposals to establish additional MCS measures for longline fisheries, including 30% ROP longline observer coverage, entry and exit reporting for high seas of the Convention Area to support verification of longline vessels that are active in the Convention Area. For catch-based purse seine fishery EEZ limits, some data from current data collection and monitoring programmes data is available to the Secretariat to verify some, but not all, CCMs limits. The Secretariat currently uses data from multiple sources to verify compliance with EEZ limits where nil purse seine activity occurred (compliance with the limits was independently verified). However, where some level of purse seine activity does occur, the current data collection and monitoring programmes may have sufficient data to partially verify purse seine catch limits. In the medium-term, it may be possible through the development of catch documentation schemes to collect additional data that will support analyses, and which will independently verify CCM-reported information in relation to compliance with catch limits	
Bycatch mitigation measures and safe handling, including catch or no-retention limits	Record of Fishing Vessels	Evaluation of most implementation obligations in the dCMR prepared by the Secretariat in 2023 involved comparing AR Pt 2 CCM self-	TCC19-2023-11 Available data for verifying compliance in the CMS IWG-ROP workplan 2023 - 2025 ERandEM WG Update

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
[size?]	Pacific Vessel Monitoring System (VMS) Regional Observer Programme Electronic Monitoring Vessel Operator Logsheet and incident reports *And data collection and monitoring programmes supporting stock assessment and estimation models, to check that management objectives are being met* Port Sampling Transhipment reporting Catch Documentation Scheme *And Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives*	reported information to the relevant Audit Point criteria, so most evaluations in the 2023 dCMR of implementation obligations were not independently verified. The short timeline between AR Pt 2 in mid-June and the initial dCMR issuance in late July, along with the current number of implementation obligations to be reviewed in the dCMR, makes it impossible for the Secretariat, as part of preparing the dCMR, to undertake detailed reviews of all CCMs national policies and procedures. Secretariat paper to WCPFC20 presents summary information relevant to the Commission's review of CMMs on non-target, associated or dependent species. Compliance information and data collected by ROP observers and through Inspection and MCS activities is used to monitor the implementation of CMMs. Work through the IWG-ROP is to refine data fields collected by ROP observers to strengthen this role. Current focus of ERandEMWG is to establish Electronic monitoring (EM).	TCC19-2023-09 Use of ROP data in the Compliance Monitoring Scheme (CMS) IWG-ROP workplan 2023 - 2025 ERandEM WG Update TCC19-2023-18 Enhanced data analysis and interpretation: Experiences and Opportunities WCPFC20-2023-21 Review of CMMs on Non-Target and Associated or Dependent Species in the WCPO
FAD measures, including time-area closures, FAD retrieval and vessel/fleet instrumented buoy limits	Record of Fishing Vessels Pacific Vessel Monitoring System (VMS) *And data collection and monitoring programmes supporting stock assessment and estimation models,*	Evaluation of most implementation obligations in the dCMR prepared by the Secretariat in 2023 involved comparing AR Pt 2 CCM self-reported information to the relevant Audit Point criteria, so most evaluations in the 2023 dCMR of implementation obligations were not independently verified. The short timeline between AR Pt 2 in mid-June and the initial dCMR issuance in late July, along with the	TCC19-2023-11 Available data for verifying compliance in the CMS TCC19-2023-16 FAD Management Options IWG Priority Task for 2023 (Progress) IWG-ROP workplan 2023 - 2025 ERandEM WG Update

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
	to check that management objectives are being met Regional Observer Programme Electronic Monitoring Vessel Operator Logsheet and incident reports FAD buoy position data *And Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives*	current number of implementation obligations to be reviewed in the dCMR, makes it impossible for the Secretariat, as part of preparing the dCMR, to undertake detailed reviews of all CCMs national policies and procedures. Current focus of the FAD Management Options IWG is to review information about current and proposed FAD measures, and to provide recommendations and advice on how to improve the monitoring, data collection and the effectiveness of the Commission's FAD management tools. Current focus of IWG-ROP is to refine data fields collected by ROP observers, and work is underway through ERandEMWG to establish E-monitoring. At SC19 PNA+ presented a proposal to establish FAD Minimum Data Fields to be recorded by Vessel Operators – this remains under discussion. Chairs consultative draft for TTM CMM includes proposals to establish reporting requirements for FAD buoy position data. Compliance information and data collected by ROP observers and through Inspection and MCS activities is used to monitor the implementation of CMMs.	SC19-ST-WP-05 FAD Minimum Data Fields to be Recorded by WCPFC Vessel Operators (25July2023) - Rev.01 WCPFC20-2023-33 Chair's Consultative Draft for a Revised Tropical Tuna Measure

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
Transhipment Regulation Scheme	Record of Fishing Vessels Pacific Vessel Monitoring System (VMS) *And data collection and monitoring programmes supporting stock assessment and estimation models, to check that management objectives are being met* Regional Observer Programme Electronic Monitoring Vessel Operator Logsheet and incident reports Transhipment reporting *And Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives*	CMM 2009-06 establishes the rules and processes for management of all transhipment in the high seas and EEZ waters of the Convention, of all highly migratory fish stocks covered by the Convention. Transhipment in a port or in waters under the national jurisdiction of a CCM shall take place in accordance with applicable national law. In 2019, the Commission adopted voluntary E-reporting standards for high seas transhipment declarations and notifications, and provides an APP to support CCMs E-reporting in accord with the E-Reporting Standards. In 2023, the Minimum Data Fields for Observer Transhipment Monitoring took effect, which will improve the flow of observer reported data that can be used to verify transhipment activities. Compliance information and data collected by ROP observers and through Inspection and MCS activities is used to monitor the implementation of CMMs. Current focus of the TS-IWG is to review and provided recommendations to strengthen the regulation and monitoring of transhipment activities in a manner consistent with the Convention. Current focus of ERandEMWG is to establish Electronic monitoring (EM). The Secretariat analytical work which commenced through consultancy in 2021/22, and which TCC19 recommended should continue through 2023-24 aims to develop	TCC19-2023-RP03 Annual Report on Transhipment Reporting TCC19-2023-18 Enhanced data analysis and interpretation: Experiences and Opportunities TS-IWG 2023 Workplan Terms of Reference for a review of CMM 2009-06 on Transshipment (2019) E-reporting Standards for high seas transshipment declarations and high seas transhipment notices ERandEM WG Update

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
		analytical tools to support CCMs verification and monitoring of transhipment activities, and to enhance the Secretariat's capability to better assist members in verifying transhipment events and to validate transhipment reporting by vessels.	
Inspection and MCS activities, and analytical interpretations of CCMs data, to support CCMs meeting Convention objective and management objectives	WCPFC High Seas Boarding and Inspection (HSBI)Scheme Port Inspections Regional Observer Programme Electronic Monitoring Market Inspections, member Aerial Surveillance activities, member at-sea boardings in areas under national jurisdiction etc	Since 2007, the HSBI Scheme has facilitated more than 970 independent boarding and inspection activities of WCPFC member vessels in the high seas of the Convention Area. Currently there are 270 registered inspection vessels for the fourteen WCPFC members, who may board and inspect vessels of other WCPFC CCMs in the high seas of the Convention Area. The Port State Minimum Standards establishes processes and procedures for CCMs to request that port inspections be undertaken on fishing vessels suspected of engaging in IUU fishing or fishing related activities in support of IUU fishing. Compliance information and data collected by ROP observers and through member MCS activities is used to monitor the implementation of CMMs. Work through the IWG-ROP is to refine data fields collected by ROP observers to strengthen this role. Current focus of ERandEMWG is to establish Electronic monitoring (EM). Data Access and Protection Rules and Procedures govern protection, access to, and dissemination of WCPFC data for various	TCC19-2023-RP04 Annual Report on HSBI TCC19-2023-RP07 Annual Report on Port Inspections and Implementation of Port State Minimum Standards TCC19-2023-09 Use of ROP data in the Compliance Monitoring Scheme (CMS) IWG-ROP workplan 2023 - 2025 ERandEM WG Update TCC19-2023-18 Enhanced data analysis and interpretation: Experiences and Opportunities

Management Tool	Data Collection or Monitoring Programme	Status of Programme	Relevant Documents
		purposes, and there are procedures for members to request access to non-public domain data for MCS activities, including in high seas waters.	TCC19-2023-RP08 Annual Report on Administration of Data Rules and Procedures

Recommendations

South Pacific albacore target reference point

35. The Commission is invited to review the list of candidate TRPs outlined in Table 4 and consider adopting a TRP for SP albacore tuna that is based on a set of reference years instead of a fixed value based on a biomass depletion percentage.

South Pacific albacore operating models

36. The Commission is invited to note that SC will further develop the reference OM set provided in Table 5 over the next year to allow the continued progress and evaluation of candidate MPs for SPA, and SC20 will consider formally adopting the reference OM set, noting the potential for other changes in light of the 2024 SPA stock assessment.

South Pacific albacore management procedure and management strategy evaluation

37. The Commission is invited to review the current set of 6 candidate MPs for initial consideration, and provide guidance based on these exploratory MPs on features to be further developed by the SSP, including performance indicators, controlled fisheries and control mechanisms, and HCR shape and design.

Implementation of skipjack management procedure

38. The Commission is invited to note the successful running of the skipjack MP as outlined in SC19-MI-WP-01, which indicates that maximum effort in the purse seine and pole-and-line fisheries and maximum catches in all other fisheries should be set to their respective baseline levels (specified in CMM 2022-01) for the period 2024-2026, when implementing CMM 2022-01. The Commission is also invited to note that a re-evaluation of the skipjack estimation method needs to be undertaken prior to the next implementation of the MP.

Monitoring strategy for skipjack tuna

39. The Commission is invited to consider the adoption of the proposed monitoring strategy for skipjack tuna as outlined in Attachment A. If a monitoring strategy is not adopted by WCPFC20 and noting that the SSP will need to evaluate the 2024 implementation of the skipjack MP in 2025 together with the skipjack stock assessment, the Commission may wish to consider tasking the SC and TCC Chairs to jointly lead intersessional work in 2024 to facilitate the development of a monitoring strategy for adoption at WCPFC21, using the information in Attachment B as a reference.

Mixed fisheries management strategy evaluation framework

40. The Commission is invited to note the progress to date on the development of the mixed fishery MSE framework and provide feedback as needed.

Attachment A[15]

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Scientific Committee
Nineteenth Regular Session
Koror, Palau
16-24 August 2023

WCPO skipjack management procedure monitoring report

This summary monitoring report is intended to provide an overview of the status of the management procedure (MP) for WCPO skipjack tuna and to allow for information to be collated progressively as elements of the MP are considered by different groups and Commission bodies (as outlined in the Appendix).

The summary monitoring report lists the elements of the WCPO skipjack MP monitoring programme, the status of those elements after review by the relevant body of the Commission, and identifies those elements that may require additional work or through which problems have been identified. Highlighted elements have a priority placed on the corresponding issue, based on the issue's considered severity and the amount of work likely required to address it. This is summarised in the table below. This report also includes summary paragraphs following the table, which provide further details of the work required.

Each of the Commission's bodies is requested to review and update their previous comments on an annual basis, as necessary.

Monitoring report summary table

Item	MP element	Commission Body	Status and comments	Priority
1. Review MP performance				
1.1	Comparison with stock assessment	SC19	Will be reviewed following implementation of the MP through the stock assessment scheduled in 2025, noting however that there will only be one year of MP implementation included within that assessment.	
1.2	Data availability & quality	SC19	The level of pole and line CPUE data in tropical regions is declining over time. If this trend continues, there may be insufficient information to inform the MP. Work should begin to evaluate alternative MPs that are robust to this potential decline in pole and line data availability.	**High**
		TCC19		
1.3	Other sources of data	SC19	No new information noted at SC19.	-
		TCC19		

[15] Attachment 3, SC19 Outcomes Document

1.4	EM performance	SC19	The EM showed acceptable performance.	
2. Review of the MP				
2.1	Management objectives	WCPFC20		-
2.2	Scope of the MP	SC19	No new information at the time of SC19.	-
		TCC19		
		WCPFC20		
2.3	Exceptional circumstances	SC19	None identified by SC19.	-
		TCC19		
		WCPFC20		
3. Review MSE framework				
3.1	Operating model grid	SC19	The OM grid (robustness set) to be augmented with climate change scenarios. Further consideration of the OM grid is also suggested given the predicted outcomes of the adopted MP and the 2022 stock assessment showed some departure for the historical period. These issues will be considered for inclusion when the current MP is reviewed.	Medium
3.2	Calculation of performance indicators	SC19	No new information at the time of SC19.	-
3.3	Modelling assumptions	SC19	While no major issues are identified, any re-evaluation of the skipjack EM (identified under 1.2) may require a re-evaluation of the modelling framework.	**High**
3.4	Data availability and quality	SC19	Generally good	
		TCC19		

Further Details

1. Review MP performance

1.1 Comparison against stock assessment outcomes: With the first implementation of MP outputs in 2024, the stock assessment for WCPO skipjack in 2025 will be the first in which the impact of the MP on stock status will be experienced. There will only be one year of MP implementation included within that assessment, so this comparison will be preliminary. A comparison of the MSE predicted outcomes of the adopted MP and the 2022 stock assessment shows good correspondence for the most recent years but shows some departure for the historical period. This is considered under 3.1.

1.2 Data availability and quality: Sufficient data were available to run the MP. However, it was noted that pole and line fishing effort in tropical regions continues to decline and this presents a potential problem for the future running of the MP. A re-evaluation of the estimation method is recommended prior to the next implementation of the MP. This issue is a high priority.

1.3 Other sources of data: No other sources of data have been identified.

1.4 EM performance: Overall the estimation method performed well and provided estimates of stock status within the prediction range of the MSE.

2. Review MP

2.1 Management objectives: No change noted by SC19.

2.2 Scope of the MP: No change noted by SC19.

2.3 Exceptional circumstances: None identified by SC19.

3. Review MSE framework

3.1 Operating model grid: OM grid to be extended to include climate change scenarios (robustness set). In particular the effects of warm pool expansion in WCPO. These analyses require further analysis of the SEAPODYM outputs and may occur over an extended timeframe. This issue is considered to be of medium priority. The comparison of the MSE predicted outcomes of the adopted MP and the 2022 stock assessment did show some departure for the historical period. This is not considered a major problem affecting the MP but some further investigation of the OM grid may be required.

3.2 Calculation of performance indicators: No change in performance indicators required at this time.

3.3 Modelling assumptions: no issues identified; however, re-evaluation of the skipjack EM (identified above) may require a re-evaluation of the modelling framework (for example the calculation of simulated data used to test the MP). This issue is of high priority.

3.4 Data availability and quality: Generally good - some changes may be required depending on the approach adopted to address the decline in pole and line fishing in tropical regions.

Appendix. Elements of the management procedure that may be considered for inclusion in the monitoring strategy and the Commission body at which those considerations can be made. (Table 2 of Annex III, CMM 2022-01).

MP Element	Commission Body	Monitoring Considerations
1. Review MP performance		
Comparison of predicted MP performance against latest assessment outcomes	SC	Check that the MP is performing as expected
Data availability to run the MP	SC/TCC	Check availability, quantity and quality of data necessary to run the MP (e.g. the estimation method)
Other sources of data to monitor performance	SC/TCC	Identify other data as available, that may not be included in the MSE framework, to inform calculation of performance indicators (economic, social, ecosystem, etc.)
Performance of the estimation method	SC	Confirm the EM is performing well and not subject to estimation failure
2. Review of the MP		
Management objectives	Commission	Check that overall objectives of the MP remain appropriate
Scope of the management procedure	SC/TCC/Comm	Confirm the fisheries controlled by the MP, and the method of control, remains

		appropriate
Exceptional circumstances	SC/TCC/Comm	Drawing on all of the above, have events (unexpected, extra-ordinary) occurred such that remedial action is required to either review modify or replace the MP
3. Review MSE framework		
Operating model grid	SC	Ensure that the most important sources of uncertainty are included in the OM grid
Calculation of performance indicators	SC	Check for appropriate representation of objectives by performance indicators
Modelling assumptions	SC	Consider the technical details of the simulation and testing framework
Data availability to support the MSE framework	SC/TCC	Improvements to data collection to either enhance the OM framework or to reduce uncertainty included in the OM grid

Attachment B

Additional detail to support the Commission's discussions and advice on respective roles in developing and implementing a monitoring strategy for skipjack tuna.

Role	SC	TCC	Commission
1. **Review of MP performance**			
a. Comparison of predicted MP performance against latest assessment outcomes	• Regularly review/check the performance and outputs of the MP, including the indicators set out in Annex III (Data requirements and monitoring strategy) of the CMM 2022-01, and provide advice to the Commission on: a) the performance of the MP as a basis for pre-defined rules that manage skipjack tuna in order to achieve biological, ecological, economic and social objectives, including the robustness of the MP to changes in the fishery and any exceptional circumstances consistent with Annex IV of the CMM 2022-01 (*refer to 2.c) below*); and		

	b) the application of the MP outputs to CMM 2021-01 (Tropical tuna CMM). • SC19: − With the first implementation of MP outputs in 2024, the stock assessment for WCPO skipjack in 2025 will be the first in which the impact of the MP on stock status will be experienced. There will only be one year of MP implementation included within that assessment, so this comparison will be preliminary. − A comparison of the MSE predicted outcomes of the adopted MP and the 2022 stock assessment shows good correspondence for the most recent years but shows some departure for the historical period.		
b. Data availability to run the MP *Refer to Annex III (Data requirements and monitoring strategy) in CMM 2022-01*	• Check availability, quantity and quality of data necessary to run the MP (e.g. the estimation method) • SC19:	• Check availability, quantity and quality of data necessary to run the MP (e.g. the estimation method) • TCC19:	

	– Sufficient data were available to run the MP. However, it was noted that pole-and-line fishing effort in tropical regions continues to decline and this presents a potential problem for the future running of the MP. A re-evaluation of the estimation method is recommended prior to the next implementation of the MP. This issue is a high priority.	– Further consideration is needed of the revision of some historical data for this run and of maintaining the historical data for future runs of the MP.	
c. Other sources of data to monitor performance	• Identify other data as available, that may not be included in the MSE framework, to inform calculation of performance indicators (economic, social, ecosystem, etc.) • SC19: – No other sources of data have been identified.	• Identify other data as available, that may not be included in the MSE framework, to inform calculation of performance indicators (economic, social, ecosystem, etc.)	
d. Performance of the estimation method (EM)	• Confirm the EM is performing well and not subject to estimation failure • SC19: – Overall the estimation method performed well and provided estimates of stock status within the		

	prediction range of the MSE.		
2. **Review of the MP**			
i. Management objectives			• Review the Tropical Tuna CMM, taking into account the output of the MP. − Check that overall objectives of the MP remain appropriate. • Revise catch and effort related limits for 2024-2026 if needed. • SC19: − No change noted by SC19.
ii. Scope of the management procedure (CMM 2022-01) Scope of the MP: "*The MP applies to the catch and effort of purse seine and pole and line fisheries, and other commercial fisheries referred to in paragraph 47 of CMM 2021-01 taking more than 2,000 tonnes of tropical tunas (bigeye, yellowfin and skipjack) in the Exclusive Economic Zones and high seas*."	• Confirm the fisheries controlled by the MP, and the method of control, remains appropriate. • SC19: 3. **No** change noted by SC19.	• Confirm the fisheries controlled by the MP, and the method of control, remains appropriate.	• Confirm the fisheries controlled by the MP, and the method of control, remains appropriate.
iii. Exceptional circumstances *Refer to Annex IV (exceptional circumstances) in CMM 2022-01*	• Either review and modify or replace the MP. • SC19: − No change noted by SC19.	• Technical assistance to identify exceptional circumstances and to take the required remedial action.	• Identify events (unexpected, extra-ordinary) occurred such that remedial action is required to either review modify or replace the MP.
4. **Review of MSE**			
a. Operating model grid	• Ensure that the most important sources of		

	uncertainty are included in the OM grid. • SC19: − OM grid to be extended to include climate change scenarios (robustness set). In particular the effects of warm pool expansion in WCPO. These analyses require further analysis of the SEAPODYM outputs and may occur over an extended timeframe. This issue is considered to be of medium priority. − Further consideration of the OM grid is also suggested given the predicted outcomes of the adopted MP and the 2022 stock assessment showed some departure for the historical period. This is not considered a major problem affecting the MP but some further investigation of the OM grid may be required.		
b. Calculation of performance indicators *<u>Six performance Indicators Examined</u>:* 1. *Indicator 1 – Maintain SKJ, YFT, BET biomass at or above levels that provide*	• Check for appropriate representation of objectives by performance indicators • SC19:		

fishery sustainability throughout their range. 2. *Indicator 3 – Maximise economic yield from the fishery (average expected catch).* 3. *Indicator 4 – Maintain acceptable CPUE.* 4. *Indicator 6 – Catch stability.* 5. *Indicator 7 – Effort stability: effort variation relative to a reference period.* 6. *Indicator 8 – Proximity of $SB/SB_{F=0}$ to the average $SB/SB_{F=0}$ in 2018-21.*	– No change in performance indicators required at this time.		
c. Modelling assumptions	• Consider the technical details of the simulation and testing framework • SC19: – No issues identified; however, re-evaluation of the skipjack EM may require a re-evaluation of the modelling framework (for example the calculation of simulated data used to test the MP). This issue is of <u>high priority</u>.		
d. Data availability to support the MSE framework	• Improvements to data collection to either enhance the OM framework or to reduce uncertainty included in the OM grid • SC19:	• Identify technical assistance to Improve data collection to either enhance the OM framework or to reduce uncertainty included in the OM grid	

	– Generally good - some changes may be required depending on the approach adopted to address the decline in pole-and-line fishing in tropical regions		