COMMISSION
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Electronic Meeting
8 – 15 December 2020

REFERENCE DOCUMENT ON OTHER RECOMMENDATOINS FROM SC16 FOR AGENDA ITEM 9.1

WCPFC17-2020-22
27 November 2020

Paper prepared by the Secretariat

The purpose of this paper is to provide a quick reference guide to recommendations from SC16 not covered under other agenda items. The structure of this document follows the format of SC16 Summary Report for its agenda and paragraph numbers.

Recommendations in the following matrix may require the Commission's attention and specific action:

SC16 Agenda	Recommendations (Paragraph numbers are from SC16 Summary Report)	Commission's Action
Shark Research Plan	261. **SC16 adopted the *2021-2025 Shark Research Plan* and recommended it to the Commission for endorsement**.	Endorse the Plan
SC work programme and budget	292. **SC16 adopted the proposed work programme and budget for 2021 and indicative budget for 2022 – 2023 and forwarded it to the Commission.**	Review and endorse this recommendation
Streamlining Annual Reporting	294. SC16 noted the updates on streamlining of annual reporting requirements implemented in 2020 that were provided in SC16-GN-IP-07 *Update on Streamlining of Annual Reporting Initiatives*. 295. SC16 also noted that SC16-GN-IP-07 reviewed the experiences and outcomes of the trial Annual Catch and Effort Estimate (ACE) Tables and has provided information that the cost and resources implications of this trial were modest. 296. **SC16 recommends to WCPFC17 that the approach of publishing the ACE tables based on the April 30 Scientific Data submissions and subsequent updates and revisions from CCMs is continued**. 297. SC16 recommends that the Scientific Services Provider is tasked to review the feasibility of expanding the ACE Tables, to include additional estimates of effort where it is practicable to be derived based on the April 30 scientific data submissions from CCMs and provide an update to SC17.	Endorse this recommendation
Next meeting	300. **SC16 recommended to the Commission that, if circumstances allow an in-person meeting to be convened, SC17 would be held in Palau during 11– 19 August 2021. Tonga offered to host SC18 in 2022**.	Endorse this recommendation

Agenda Item 2 — DATA AND STATISTICS THEME

2.1 Data gaps of the Commission

34. SC16 recommended that updated versions of SC16-ST-WP-01 (Data gaps) and SC16-ST-IP-02 (ROP data management) be forwarded to TCC16 for consideration.

Agenda Item 3 — STOCK ASSESSMENT THEME

3.4 North Pacific albacore (*Thunnus alalunga*)

a. Stock status and trends

147. **SC16 noted that the ISC provided the following conclusions on the stock status of North Pacific albacore.**

> The Northern Committee (NC) of the Western and Central Pacific Fisheries Commission (WCPFC), which manages this stock together with the Inter American Tropical Tuna Commission (IATTC), adopted a biomass-based limit reference point (LRP) in 2014 (https://www.wcpfc.int/harvest-strategy) of 20% of the current spawning stock biomass when F=0 ($20\%SSB_{current,\ F=0}$). The $20\%SSB_{current,\ F=0}$ LRP is based on dynamic biomass and fluctuates depending on changes in recruitment. For north Pacific albacore tuna, this LRP is calculated as 20% of the unfished dynamic female spawning biomass in the terminal year of this assessment (i.e., 2018) (https://www.wcpfc.int/meetings/nc13). However, neither the IATTC nor the WCFPC have adopted F-based limit reference points for the north Pacific albacore stock.
>
> Stock status is depicted in relation to the limit reference point (LRP; $20\%SSB_{current,\ F=0}$) for the stock and the equivalent fishing intensity ($F_{20\%}$; calculated as $1\text{-}SPR_{20\%}$) (Figure NPALB-1). Fishing intensity (F, calculated as 1-SPR) is a measure of fishing mortality expressed as the decline in the proportion of the spawning biomass produced by each recruit relative to the unfished state. For example, a fishing intensity of 0.8 will result in a SSB of approximately 20% of SSB_0 over the long run. Fishing intensity is considered a proxy of fishing mortality.
>
> The Kobe plot shows that the estimated female SSB has never fallen below the LRP since 1994, albeit with large uncertainty in the terminal year (2018) estimates. Even when alternative hypotheses about key model uncertainties such as growth were evaluated, the point estimate of female SSB in 2018 (SSB_{2018}) did not fall below the LRP, although the risk increases with this more extreme assumption (Figure NPALB-1). The SSB_{2018} was estimated to be 58,858 t (95% CI: 27,751 – 89,966 t) and 2.30 (95% CI: 1.49 – 3.11) times greater than the estimated LRP threshold of 25,573 mt (95% CI: 19,150 – 31,997 t) (Table NPALB-1). Current fishing intensity, $F_{2015\text{-}2017}$ (0.50; 95% CI: 0.36 – 0.64; calculated as $1\text{-}\ SPR_{2015\text{-}2017}$) , was at or lower than all seven potential F-based reference points identified for the north Pacific albacore stock (Table NPALB-1).

148. **SC16 noted the following stock status from ISC:**

> Based on these findings, the following information on the status of the north Pacific albacore stock is provided:

1) The stock is likely not overfished relative to the limit reference point adopted by the Western and Central Pacific Fisheries Commission ($20\%SSB_{current,\ F=0}$), and
2) No F-based reference points have been adopted to evaluate overfishing. Stock status was evaluated against seven potential reference points. Current fishing intensity ($F_{2015\text{-}2017}$) is likely at or below all seven potential reference points (see ratios in Table NPALB-1).

b. Management advice and implications

149. **SC16 noted the following conservation information from ISC:**

Two harvest scenarios were projected to evaluate impacts on future female SSB: F constant at the 2015-2017 rate over 10 years ($F_{2015\text{-}2017}$) and constant catch[1] (average of 2013-2017 = 69,354 t) over 10 years. Median female SSB is expected to increase to 62,873 mt (95% CI: 45,123 - 80,622 mt) by 2028, with a low probability of being below the LRP by 2028, if fishing intensity remains at the 2015-2017 level (Figure NPALB-2). If future catch is held constant at 69,354 mt, the female SSB is expected to increase to 66,313 mt (95% CI: 33,463 - 99,164 t) by 2028 and the probability that female SSB will be below the LRP by 2028 is slightly higher than the constant F scenario (Figure NPALB-3). Although the projections appear to underestimate the future uncertainty in female SSB trends, the probability of breaching the LRP in the future is likely small if the future fishing intensity is around current levels.

Based on these findings, the following information is provided:

1) If a constant fishing intensity ($F_{2015\text{-}2017}$) is applied to the stock, then median female spawning biomass is expected to increase to 62,873 mt and there will be a low probability of falling below the limit reference point established by the WCPFC by 2028.
2) If a constant average catch ($C_{2013\text{-}2017}$ = 69,354 t) is removed from the stock in the future, then the median female spawning biomass is also expected to increase to 66,313 mt and the probability that SSB falls below the LRP by 2028 will be slightly higher than the constant fishing intensity scenario.

Table NPALB-1. Estimates of maximum sustainable yield (MSY), female spawning biomass (SSB), and fishing intensity (F) based reference point ratios for north Pacific albacore tuna for: 1) the base case model; 2) an important sensitivity model due to uncertainty in growth parameters; and 3) a model representing an update of the 2017 base case model to 2020 data. SSB_0 and SSB_{MSY} are the unfished biomass of mature female fish and at MSY, respectively. The Fs in this table are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflect changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality. Current fishing intensity is based on the average fishing intensity during 2015-2017 ($F_{2015\text{-}2017}$). $20\%SSB_{current,\ F=0}$ is 20% of the current unfished dynamic female spawning biomass, where current refers to the terminal year of this assessment (i.e., 2018). The model representing an update of the 2017 base case model is highly similar to but not identical to the 2017 base case model due to changes in data preparation and model structure.

Quantity	Base Case	Growth CV = 0.06 for L_{inf}	Update of 2017 base case model to 2020 data
MSY (t) [A]	102,236	84,385	113,522
SSB_{MSY} (t) [B]	19,535	16,404	21,431
SSB_0 (t) [B]	136,833	113,331	152,301

[1] It should be noted that the constant catch scenario is inconsistent with current management approaches for north Pacific albacore tuna adopted by the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission (WCPFC).

SSB_{2018} (t) [B]	58,858	34,872	77,077
$SSB_{2018}/20\%SSB_{current,\ F=0}$ [B]	2.30	1.63	2.63
$F_{2015\text{-}2017}$	0.50	0.64	0.43
$F_{2015\text{-}2017}/F_{MSY}$	0.60	0.77	0.52
$F_{2015\text{-}2017}/F_{0.1}$	0.57	0.75	0.49
$F_{2015\text{-}2017}/F_{10\%}$	0.55	0.71	0.48
$F_{2015\text{-}2017}/F_{20\%}$	0.62	0.80	0.54
$F_{2015\text{-}2017}/F_{30\%}$	0.71	0.91	0.62
$F_{2015\text{-}2017}/F_{40\%}$	0.83	1.06	0.72
$F_{2015\text{-}2017}/F_{50\%}$	1.00	1.27	0.86

A – MSY includes male and female juvenile and adult fish
B – Spawning stock biomass (SSB) in this assessment refers to mature female biomass only.

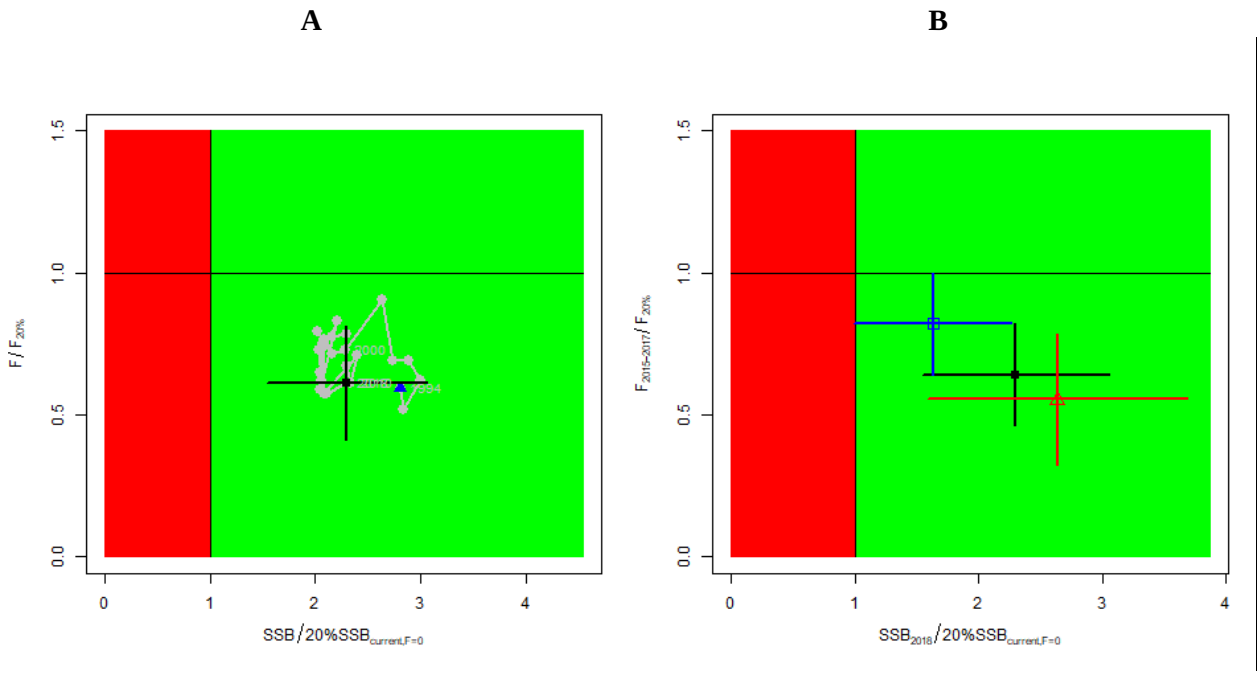

Figure NPALB-1. (**A**) Kobe plot showing the status of the north Pacific albacore (*Thunnus alalunga*) stock relative to the $20\%SSB_{current,\ F=0}$ biomass-based limit reference point, and equivalent fishing intensity ($F_{20\%}$; calculated as $1\text{-}SPR_{20\%}$) over the base case modeling period (1994-2018). Blue triangle indicates the start year (1994) and black circle with 95% confidence intervals indicates the terminal year (2018). (**B**) Kobe plot showing current stock status and 95% confidence intervals of the base case model (black; closed circle), an important sensitivity run of CV = 0.06 for L_{inf} in the growth model (blue; open square), and a model representing an update of the 2017 base case model to 2020 data (red; open triangle). The coefficients of variation of the $SSB/20\%SSB_{current,\ F=0}$ ratios are assumed to be the same as for the $SSB/20\%SSB_0$ ratios. Fs in this figure are not based on instantaneous fishing mortality. Instead, the Fs are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflects changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality. Current fishing intensity is calculated as the average fishing intensity during 2015-2017 ($F_{2015\text{-}2017}$), while current female spawning biomass refers to the terminal year of this assessment (i.e., 2018). The model representing an update of the 2017 base case model is highly similar to but not identical to the 2017 base case model due to changes in data preparation and model structure.

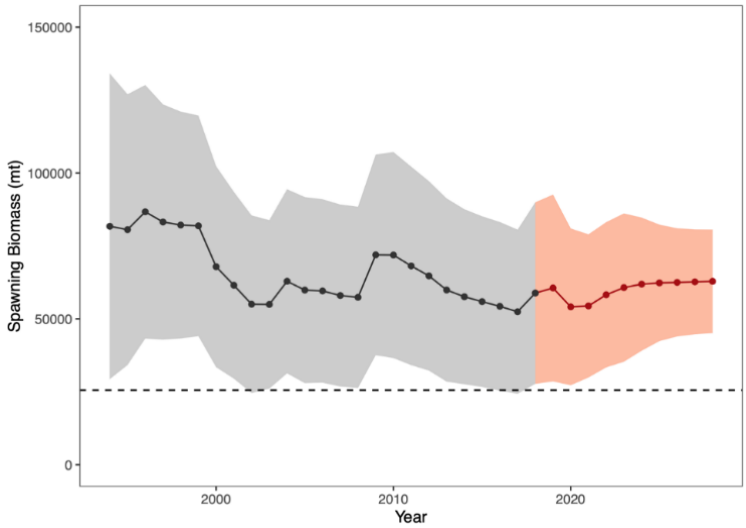

Figure NPALB-2. Historical and future trajectory of north Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant fishing intensity ($F_{2015\text{-}2017}$) harvest scenario. Future recruitment is based on the expected recruitment variability. Black line and gray area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Red line and red area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. Dashed black line indicates the $20\%SSB_{current\ F=0}$ limit reference point for 2018 (25,573 mt).

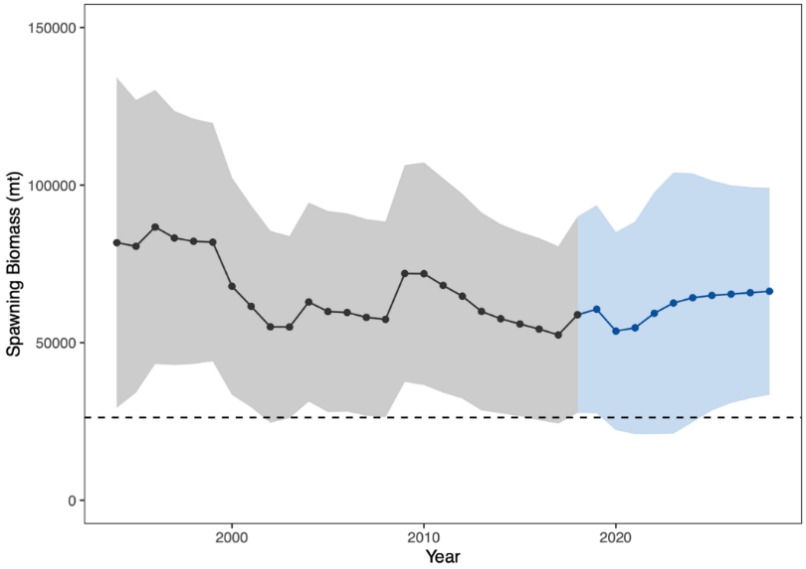

Figure NPALB-3. Historical and future trajectory of north Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant catch (average 2013-2017 = 69,354 t) harvest scenario. Future recruitment is based on the expected recruitment variability. Black line and blue area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Blue line and blue area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. Dashed black line indicates the $20\%SSB_{current\ F=0}$ limit reference point for 2018 (25,573 mt).

3.6 Other stock assessment issues

3.6.1 Structural uncertainty grid and projections

179. For species that have assessments that consider axes of uncertainty in a grid approach, the Scientific Services Provider and CCMs should develop objective criteria to quantitatively evaluate the inclusion of axes and respective weighting within each axis to characterize stock status uncertainty. These should be discussed at the SPC pre-assessment workshop.

180. The Scientific Services Provider and CCMs should develop criteria to illustrate a relevant sub-set of diagnostics for all assessment models within the relevant uncertainty grid.

181. For stock assessment projections, provide median estimates of F/F_{MSY}, $SB/SB_{F=0}$, the risk of breaching an adopted LRP and the probability of being below any interim TRP, at 10 year increments from the beginning of the projection time period.

182. SC16 recommends that the Scientific Services Provider and CCMs should develop criteria to illustrate a relevant sub-set of diagnostics for all assessment models within the relevant uncertainty grid. The Scientific Services Provider and CCMs should develop objective criteria to quantitatively evaluate the inclusion of axes and respective weighting within each axis to characterize stock status uncertainty. This includes the development of standard protocols for weighting alternative models in the ensemble model approach used for stock assessments and management advice. The goal is to develop an objective procedure to down-weigh poorly fitting models and up-weight well-predicting models. To accomplish this, SC16 recommends that the Scientific Services Provider and CCMs hold workshop(s) to develop standard protocols for model weight calculations for assessments that use an uncertainty grid.

3.6.2 Peer review

188. SC16 supports an external expert peer review of the yellowfin stock assessment. This would also allow several components of the bigeye tuna assessment to be reviewed given the similar data input structure. This review would examine a number of issues such as model complexity, weighting of data sources, spatial approaches and the extreme sensitivity to assumptions on growth amongst a range of other issues.

189. SC16 provides the following provisional time-line for an external expert peer review.

a) Year 1 would be set aside to allow the SSP to conduct an initial range of testing and analysis internally focused on YFT and report these findings to SC17. SC17 to finalize ToRs for the external expert review.
b) Year 2 would be set aside for the SSP to conduct further testing and analysis internally focused on BET and YFT, following SC17 input, and for the external expert review (commencing at the start of 2022) with the review reporting to SC18.
c) Year 3 would provide updated YFT and BET stock assessments which respond to the review. The two assessments would be reported to SC19.

190. In accordance with this, SC16 identified the external review as a project in the budget (provisionally estimated at $USD 50,000) but with no funding commitment until 2022 and 2023.

191. SC16 also tasked the SSP with preparing a draft terms of reference for the external expert review for the consideration of SC17 which would be informed by their analyses during 2021. The draft terms of reference would give consideration to including the bigeye stock assessment in the external review process.

192. Further, SC16 noted that peer review experts of the required calibre may not be easy to secure, thus efforts should be made during late 2020/early 2021 to have them express interest and availability.

3.6.3 Stock assessment schedule

198. SC16 recommended inquiring with the IATTC regarding the potential scheduling for a collaborative Pacific-wide bigeye tuna, south Pacific albacore and south Pacific swordfish assessment. Initial correspondence from the IATTC indicated that their scheduling of stock assessments would occur during the 2020 Scientific Advisory Committee.

Table 1. WCPFC provisional assessment schedule 2021-2025 as discussed in the Plenary session. In the schedule, Tuna are scheduled for assessment every 3 years; swordfish every 4 years; and sharks and other billfish every 5 years.

Species	Stock	Last assessment	2021	2022	2023	2024	2025
Bigeye tuna	WCPO	2020			X		
	Pacific	2015	X?				
Skipjack tuna	WCPO	2019		X			X
Yellowfin tuna	WCPO	2020			X		
Albacore	S Pacific	2018	X			X	
	N Pacific	2020			X		
Pacific bluefin	N Pacific	2020		X		X	
Striped marlin	SW Pacific	2019				X	
	NW Pacific	2019				X	
Swordfish	SW Pacific	2017	X				
	N Pacific	2018		X			
Pacific blue marlin	Pacific		X				
Silky Shark	WCPO	2018			X		
Oceanic whitetip shark	WCPO	2019					
Blue shark	S Pacific	2016	X				
	N Pacific	2017		X			
Mako	N Pacific	2018				X	
	SW Pacific			X			
Bigeye thresher	Pacific	2017					
Porbeagle	S Pacific	2017					

Agenda Item 5 — FUTURE WORK PROGRAMME AND BUDGET

5.1 Development of the 2021 work programme and budget, and projection of 2021-2023 provisional work programme and indicative budget

261. SC16 adopted the *2021-2025 Shark Research Plan* and recommended it to the Commission for endorsement.

272. SC16 agreed to resume SC16 meeting prior to WCPFC17 to discuss and finalize the SC work programme and budget for 2021, and provisional work programme and indicative budget for 2022-2023. It was agreed that the Secretariat would inform CCMs of the details of the Resume SC16 Meeting through a circular.

275. SC16 agreed that the 2021 scientific services from SPC would comprise (i) the South Pacific albacore stock assessment; (ii) the Southwest Pacific swordfish stock assessment; and (iii) additional analyses related to yellowfin tuna in preparation for the stock assessment peer review.

292. SC16 adopted the proposed work programme and budget for 2021 and indicative budget for 2022 – 2023 (Table 2) and forwarded it to the Commission.

Table 2. Summary of SC work programme titles and budget for 2021, and indicative budget for 2022–2023, which requires funding from the Commission's core budget (USD).

Project Title	TOR	Essential	Priority Rank	2021	2022	2023
SPC-OFP scientific services		Yes	High 1	943,014	961,875	981,112
SPC Additional resourcing		Yes	High 1	169,810	173,206	176,670
P35b. WCPFC Tissue Bank	SC15-Att.G	Yes	High 1	101,180	103,204	105,268
P42. Pacific Tuna Tagging Program	SC15-Att.G	Yes	High 1	730,000	730,000	730,000
P60. PS Species Composition	SC15-Att.G	No		40,000		
P65. Peer review of stock assessment modelling (bigeye and yellowfin tuna)	SC17				50,000	
P68. Seabird mortality	SC15-Att.G	No	High 2		75,000	
P88. Acoustic FAD analyses	SC15-Att.G		High 2	15,000		
P90. Length weight conversion	SC15-Att.G	No	High 2	20,000	75,000	
P100b. Feasibility of Close-Kin Mark-Recapture assessment for South Pacific albacore in the WCPO	SC16-GN-IP-08		High 2	0		
P101. Monte Carlo simulations - shark mitigation	SC15-Att.G		High 1			
P102. Population projections for oceanic whitetip shark	SC15-Att.G		High 1			
P104. Appropriate LRPs for Southwest Pacific Ocean striped marlin and other billfish	SC16-GN-IP-08		High 1	31,000		
P105. Bomb radiocarbon age validation for bigeye and yellowfin tunas in the WCPO	SC16-GN-IP-08		High2	97,980		
P106. Ageing of South Pacific albacore	SC16-GN-IP-08		High 1	0		
P107. SP blue shark assessment	SC16-GN-IP-08		High 2	20,000		
P108. WCPO silky shark assessment	SC16-GN-IP-08				100,000	
P109. Training observers for elasmobranch biological sampling	SC16-GN-IP-08		High 1	25,000		
P110. Non-entangling and biodegradable FADs			High 1	0		
Total Project Budget				**1,249,970**	**1,306,409**	**1,011,938**
Total Budget with SPC-SSA				**2,192,984**	**2,268,284**	**1,993,050**

5.2 Streamlining Annual Reporting

294. SC16 noted the updates on streamlining of annual reporting requirements implemented in 2020 that were provided in SC16-GN-IP-07 *Update on Streamlining of Annual Reporting Initiatives*.

295. SC16 also noted that SC16-GN-IP-07 reviewed the experiences and outcomes of the trial Annual Catch and Effort Estimate (ACE) Tables and has provided information that the cost and resources implications of this trial were modest.

296. SC16 recommends to WCPFC17 that the approach of publishing the ACE tables based on the April 30 Scientific Data submissions and subsequent updates and revisions from CCMs is continued.

297. SC16 recommends that the Scientific Services Provider is tasked to review the feasibility of expanding the ACE Tables, to include additional estimates of effort where it is practicable to be derived based on the April 30 scientific data submissions from CCMs and provide an update to SC17.

Agenda Item 6 — ADMINISTRATIVE MATTERS

6.2 Election of officers of the Scientific Committee

299. The Chair noted the discussion held at the HOD meeting prior to SC16 regarding the need for co-conveners for the EB and MI theme, as a result of the impending retirement of John Annala (EB Theme co-convener), and Rob Campbell (MI theme co-convener); Rob noted that he would seek to be available to assist a new MI co-convener at SC17. The SC Chair, Vice-Chair and other theme conveners confirmed they would continue to serve in their current roles for SC17.

6.3 Next meeting

300. SC16 recommended to the Commission that, if circumstances allow an in-person meeting to be convened, SC17 would be held in Palau during 11– 19 August 2021. Tonga offered to host SC18 in 2022.