



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

**Twelfth Regular Session of the Scientific Committee
Bali, Indonesia
3-11 August 2016**

SUMMARY REPORT

26 August 2016

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**The Commission for the Conservation and Management of
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**Scientific Committee
Twelfth Regular Session**

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EXECUTIVE SUMMARY

AGENDA ITEM 1 – OPENING OF THE MEETING

1. The Twelfth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean took place from 3-11 August 2016 at the Stones Hotel in Bali, Indonesia.

2. The following WCPFC CCMs attended SC12: American Samoa, Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, Indonesia, Japan, Kiribati, Republic of Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tokelau, Tonga, Tuvalu, United States of America (USA), Vanuatu, Vietnam and Wallis and Futuna.

3. The Commission Chair, Ms Rhea Moss-Christian, the SC Chair, Ms Berry Muller (RMI), the WCPFC Executive Director Mr Feleti Teo, and the Chairman of the Agency of Marine and Fisheries Research and Development of Indonesia, Mr Muhammad Zulficar Mochtar, delivered opening and welcome speeches.

4. The theme conveners and their assigned themes are:

Data and Statistics theme	B. Muller (RMI)
Stock Assessment theme	J. Brodziak (USA) and H. Nishida (Japan)
Management Issues theme	R. Campbell (Australia)
Ecosystem and Bycatch Mitigation theme	J. Annala (NZ) and A. Batibasaga (Fiji)

5. SC12 established 11 informal small groups (ISGs) to facilitate the meeting process. The facilitators for the twelve ISGs were:

ISG-1	Development of SC Budget for 2017 – 2019	B. Muller
ISG-2	Project 57 – Scope of work for shark limit reference points	R. Campbell
ISG-3	A formal process for the independent review of stock assessment	K. Bigelow
ISG-4	Definition of public domain data and amendment of the <i>Scientific Data to be provided to the Commission</i>	L. Olsen
ISG-5	Designation of key shark species	S. Varsamos
ISG-6	Review of Shark Research Plan and future work plan	J. Larcombe
ISG-7	Ecosystem indicators and budget	Withdrawn
ISG-8	Development of <i>New guidelines for the survival of sharks (other than whale sharks) to be released from longline or purse-seine gear</i>	H. Kiyofuji
ISG-9	Review of Tissue Bank Protocol	N. Smith

ISG-10	Finalize Bycatch Data Exchange Protocol (BDEP) template	N. Smith
ISG-11	Guidelines for development and evaluation of shark management plan	S. Clarke
ISG-12	Future arrangements for the support of management strategy evaluation	R. Campbell

6. The SC12 provisional agenda WCPFC-SC12-2016-02_rev4 was adopted.

AGENDA ITEM 2 – REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries

7. The provisional total WCP–CA tuna catch for 2015 was estimated at 2,687,840 mt, the third highest on record and nearly 200,000 mt below the previous record catch in 2014 (2,882,511 mt); this catch represented 80% of the total Pacific Ocean catch of 3,379,789 mt, and 56% of the global tuna catch (the provisional estimate for 2015 is 4,799,697 mt, and when finalised is expected to be the second highest on record).

8. The 2015 WCP–CA catch of skipjack (1,827,750 mt – 68% of the total catch) was the third highest recorded, nearly 180,000 mt less than the record in 2014 (2,005,647 mt). The WCP–CA yellowfin catch for 2015 (605,963 mt – 23%) was the second highest recorded (less than 1,000 mt lower than the record catch of 2008 – 606,868 mt); the increase in yellowfin tuna catch from 2014 levels was mainly due to increased catches in the Indonesia and Philippines domestic fisheries. The WCP–CA bigeye catch for 2015 (134,084 mt – 5%) was the lowest since 1996 due to relatively low catches in the longline and purse seine fisheries. The 2015 WCP–CA albacore catch (120,043 mt - 4%) was the lowest since 2011 and nearly 28,000 mt lower than the record catch in 2002 at 147,793 mt. The WCP–CA albacore catch includes catches of north and south Pacific albacore in the WCP–CA, which comprised 81% of the total Pacific Ocean albacore catch of 149,289 mt in 2015. The south Pacific albacore catch in 2015 (68,594 mt) was about 12,000 mt lower than in 2014 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt.

9. The provisional 2015 purse-seine catch of 1,766,070 mt was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear.

10. The 2015 pole-and-line catch (228,129 mt) was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s. Japanese distant-water and offshore fleets (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP–CA pole-and-line catch (99% in 2015).

11. The provisional WCP–CA longline catch (243,547 mt) for 2015 was lower than the average for the past five years. The WCP–CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for

three years, 21,000 mt. lower than the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery. The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past ten years.

12. The 2015 South Pacific troll albacore catch (2,576 mt) was around the average over the past decade. The New Zealand troll fleet (131 vessels catching 2,425 mt in 2015) and the United States troll fleet (6 vessels catching 151 mt in 2015) accounted for all of the 2015 albacore troll catch.

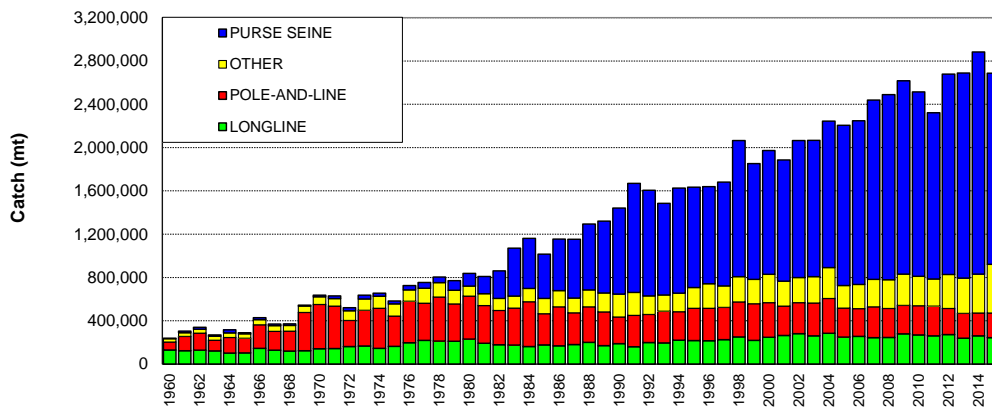


Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA, by longline, pole-and-line, purse seine and other gear types

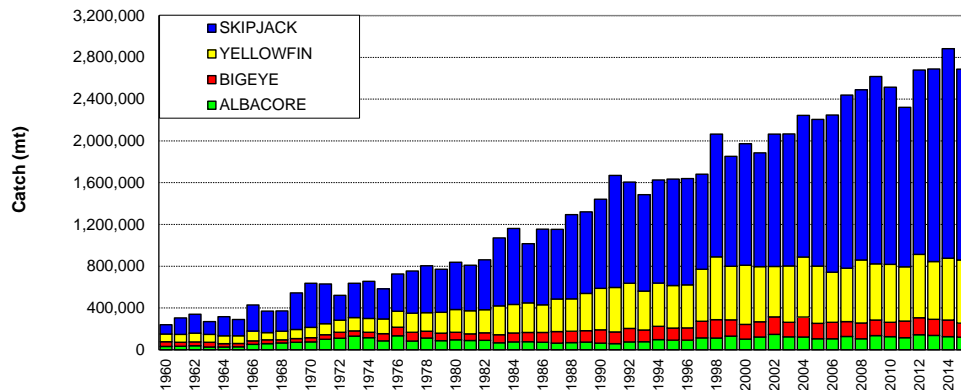


Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA

AGENDA ITEM 3 – DATA AND STATISTICS THEME

3.1 Data gaps

13. SC12 recommended that:

- a) The paper SC12-ST-IP-02 (Status of observer data management) is forwarded to TCC12, highlighting the gaps in ROP longline coverage.
- b) The Scientific Services Provider calculate annual coefficients of variation (CVs) for various taxa collected from longline observer data for 2013, 2014 and 2015, and present this information to SC13.

14. SC12 recommended that the Scientific Services Provider proceed with the proposed work plan for Project 60 (Collection and evaluation of purse seine species composition data) as endorsed by SC12.

15. SC12 recommended that WCPFC continue the work which would include exploring mechanisms for obtaining complete cannery receipt or equivalent data for validating the purse seine catch and evaluating the usefulness of these data.

3.2 Electronic monitoring and electronic reporting

16. The Scientific Committee endorsed the recommendations as outlined in SC12-ST-WP-07 (Agreed recommendations from ERandEM-WG2).

17. SC12 supported outcomes and recommendations from the second meeting of the WCPFC E-Reporting and E-monitoring Working Group (ERandEM WG-2, August 2016) and that they are taken forward to TCC12.

18. SC12 noted that CCMs agreed to provide comments on the draft WCPFC E-Reporting standard data fields for logsheet and observer data prior to 10th September 2016, so that the WCPFC Secretariat and Science Services Provider can compile comments for presentation to TCC12.

3.3 WCPFC-funded Port Coordinators

19. SC12 recommended that the WCPFC Secretariat consider the requests of several CCMs to expand the support of the Port Coordinators initiative and report a proposal at TCC12.

3.4 Review of Scientific Data to be provided to the Commission

20. SC12 noted the work of the SC12 informal small working group on data (ISG-4) and that the recommendations in the report of ISG-4 (available as SC12-ST-WP-09_rev2) are taken forward.

a) With respect to “the proposal to modify the definition of the WCPFC public domain data to align to the IATTC definition”, the changes proposed by ISG-4 are to be forwarded to TCC12 for consideration.

b) With respect to the review of the elements proposed in SC12-ST-WP-05 (European Union proposal for an amendment of the "Scientific data to be provided to the Commission), the revised document by ISG-4 are to be forwarded to TCC12 for further work.

3.5 FAD Management Options Intersessional Working Group

21. SC12 endorsed the work and the FADMgmtOptions-IWG work plan.

3.6 Economic data

22. SC12 recommended that:

a) An annual update of “Analyses and projections of economic conditions in WCPO fisheries”, in a similar manner to SC12-ST-WP-04, continue to be provided at SC meetings.

- b) These economic analyses be made available to, and be used by, the Commission in the development of harvest strategies and management measures.
- c) SC13 considers guidelines for the voluntary submission of economic data to the Commission by CCMs, recognizing the value of economic data to the work of the Commission.

AGENDA ITEM 4 – STOCK ASSESSMENT THEME

4.1 WCPO tunas

4.1.1 WCPO bigeye tuna (*Thunnus obesus*)

Stock status and trends

- 23. SC12 noted that no stock assessment was conducted for WCPO bigeye tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>
- 24. SC12 noted that the total bigeye catch in 2015 was 134,084 mt, which was a 16% decrease over 2014 and a 13% decrease over the average for 2010-14.
- 25. Purse seine bigeye catch in 2015 was 26% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 13% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower.
- 26. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013-2015 and which assumed that recent above-average recruitments continued, indicated that the median spawning biomass depletion (SB/SBF=0) of bigeye has been relatively stable since the 2012 assessment.
- 27. SC12 also noted the importance of retrospective analyses as a diagnostic tool for WCPFC stock assessments. Further, retrospective forecasting of the 2014 WCPO bigeye tuna stock assessment found that the 2014 bigeye tuna stock assessment model is not subject to substantial retrospective bias.
- 28. In addition, SC12 noted that short-term projections conducted using the results of the 2014 bigeye tuna reference case assessment model provide consistent and relatively accurate indications of stock status in the short-term.
- 29. SC12 notes that the projected median spawning biomass depletion of bigeye in 2016 was SB2015/SBF=0 = 0.17. It was also noted that short-term stochastic projections using only the reference case model are likely to underestimate uncertainty in projected stock status.

Management advice and implications

- 30. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For

further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.1.2 WCPO yellowfin tuna (*Thunnus albacares*)

Stock status and trends

31. SC12 noted that no stock assessment was conducted for WCPO yellowfin tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

32. SC12 noted that the total yellowfin catch in 2015 was 605,963 mt, a 2% increase over 2014 and a 7% increase over the average for 2010-14.

33. Purse seine yellowfin catch in 2015 was 15% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 2% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower. Catches of other gears increased by 47% from 2014 to 2015.

34. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013-2015 indicated that the projected median spawning biomass depletion (SB/SBF=0) of yellowfin showed an increasing trend since 2012. SC12 also noted that the projected median spawning biomass depletion of yellowfin in 2016 was $SB_{2015}/SBF=0 = 0.49$.

Management advice and implications

35. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.1.3 WCPO skipjack tuna (*Katsuwonus pelamis*)

Stock status and trends

36. SC12 noted that the skipjack catch in 2015 was 1,827,750 mt, was a 9% decrease over 2014 and a 3% increase over the average for 2010-14.

37. Purse seine skipjack catch in 2015 was 13% lower than that in 2014 and effort 21% lower.

38. The SC12 was unable to reach consensus on the description of stock status based on the 2016 stock assessment.

39. SC12 notes that the majority of member countries agreed on the following description of WCPO skipjack tuna status and trends.

Majority view of stock status and trends

40. A majority of SC12 CCMs selected the reference case model as the base case to represent the stock status of skipjack tuna (column “Ref Case” in Table SKJ2). To characterize uncertainty,

those CCMs chose the structural uncertainty grid. Summaries of important model quantities for these models are shown in Table SKJ2.

Table SKJ1. Description of the structural sensitivity grid used to characterise uncertainty in the assessment. The reference case option is denoted in bold face.

Axis	Levels	Option
Steepness	3	0.65, 0.80 , or 0.95
Mixing period	2	1 quarter mixing , 2 quarters mixing
Length composition weighting	3	Sample sizes divided by 10, 20 , or 50
Tagging overdispersion	3	Default level , Estimated, or Fixed (moderate) level

Table SKJ2: Estimates of management quantities for the selected stock assessment models. For the purpose of this assessment, “recent” is the average over the period 2011–2014 and “latest” is 2015. The column “Ref Case” shows summaries for the reference case and the remaining columns are the quantiles of the structural uncertainty grid, e.g. 5% and 50% are the 5% quantile and the median (50% quantile), respectively. Option 1 in the text recommends basing management advice on the reference case model and considering the uncertainty represented by the 5% and 95% quantile columns. Option 2 recommends basing management advice on the range of model runs in the structural uncertainty grid, as represented by the 5% and 95% quantile columns.

Quantity	Ref Case	50%	5%	25%	75%	95%
C_{latest}	1,679,528	1,679,444	1,678,646	1,679,170	1,679,497	1,679,592
MSY	1,891,600	1,875,600	1,618,060	1,785,400	1,976,700	2,199,880
$Y_{F_{recent}}$	1,594,800	1,607,000	1,486,660	1,533,200	1,755,200	1,808,860
f_{mult}	2.23	2.07	1.57	1.85	2.29	2.62
F_{MSY}	0.24	0.24	0.21	0.22	0.26	0.28
F_{recent}/F_{MSY}	0.45	0.48	0.38	0.44	0.54	0.64
SB_{MSY}	1,626,000	1,628,000	1,258,700	1,425,750	1,852,750	2,166,100
SB_0	6,764,000	6,359,500	5,214,050	5,853,750	7,095,250	8,340,450
$SB_{F=0}$	7,221,135	6,876,526	5,778,079	6,408,578	7,425,353	8,555,240
SB_{latest}/SB_0	0.62	0.55	0.43	0.49	0.59	0.71
$SB_{latest}/SB_{F=0}$	0.58	0.51	0.39	0.47	0.57	0.67
SB_{latest}/SB_{MSY}	2.56	2.15	1.6	1.81	2.43	3.08
$SB_{recent}/SB_{F=0}$	0.52	0.49	0.4	0.46	0.52	0.57
SB_{recent}/SB_{MSY}	2.31	2.04	1.58	1.82	2.32	2.65

41. Trends in estimated recruitment, spawning biomass, fishing mortality and depletion are shown in Figures SKJ 1-4.

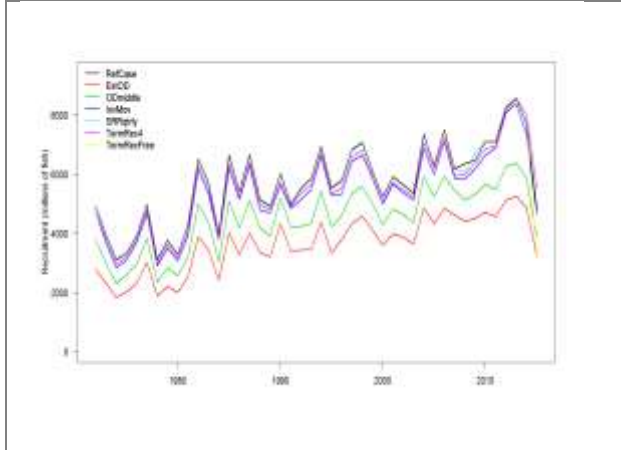


Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference case model and six additional runs.

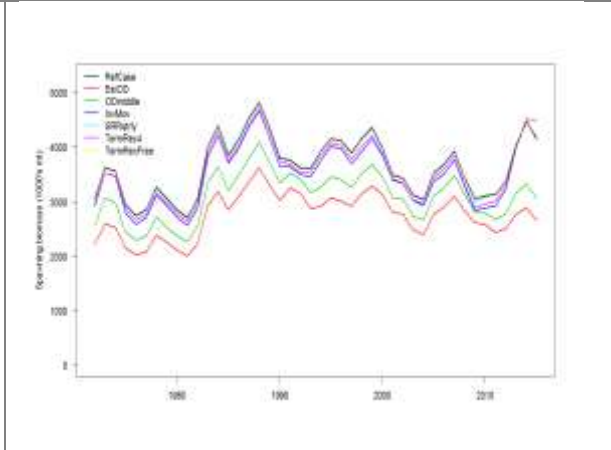


Figure SKJ2: Estimated annual average spawning potential for the WCPO obtained from the reference case model and six additional runs.

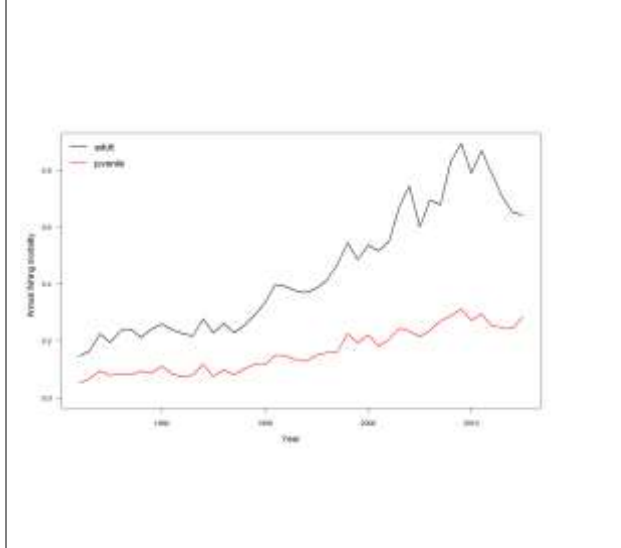


Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

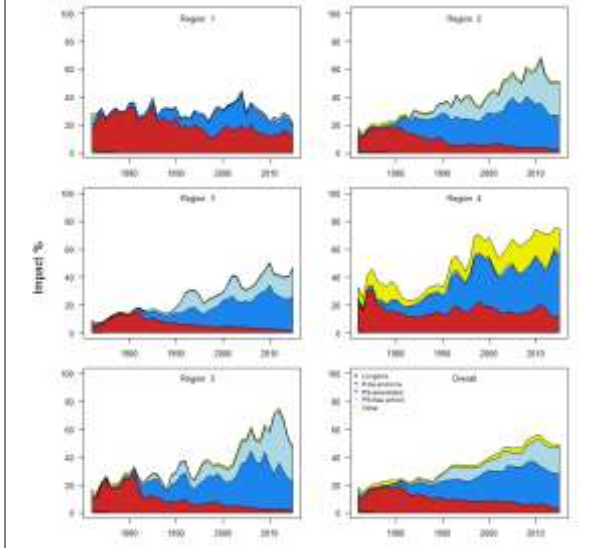
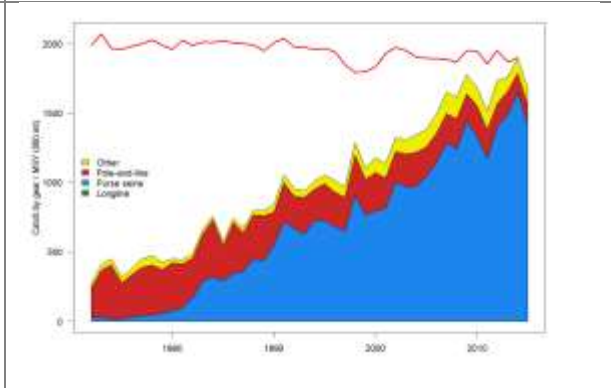
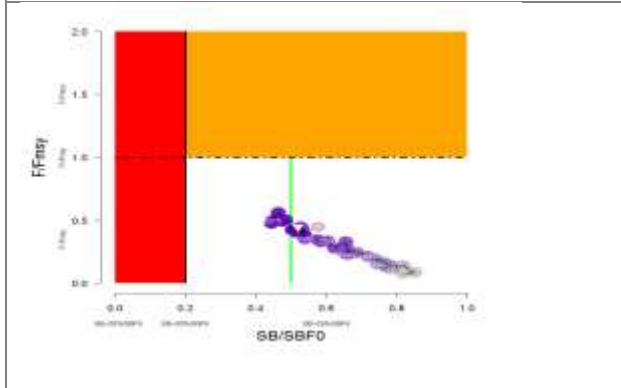
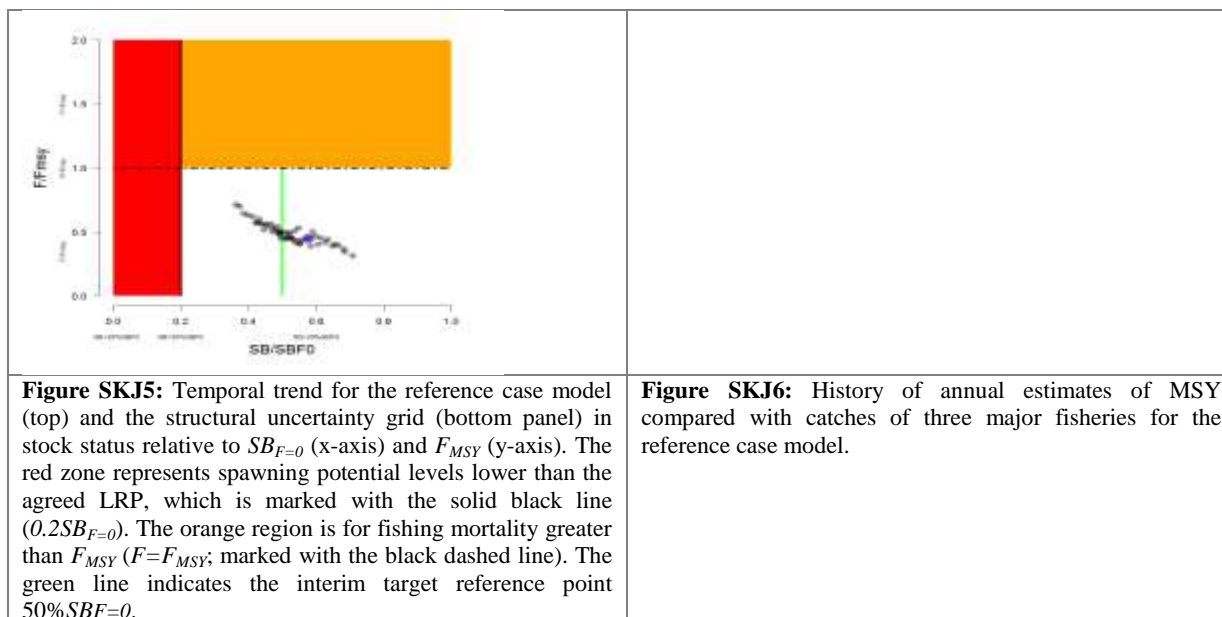


Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB/SB_{t,F=0}$) by region and for the WCPO attributed to various fishery groups for the reference case model.





42. Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass.

43. Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY ($F_{\text{recent}}/F_{\text{MSY}} = 0.45$ for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid $F_{\text{recent}}/F_{\text{MSY}}$ varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock (Figure SKJ 5).

44. The estimated MSY of 1,891,600 mt is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value (Figure SKJ 6).

45. The latest (2015) estimate of spawning biomass is well above both the level that will support MSY ($S_{\text{latest}}/S_{\text{BMSY}} = 2.56$, for the reference case model) and the adopted LRP of 0.2 $S_{\text{BF}=0}$ ($S_{\text{latest}}/S_{\text{BF}=0} = 0.58$, for the reference case model), and $S_{\text{latest}}/S_{\text{BF}=0}$ was relatively close to the adopted interim target reference point (0.5 $S_{\text{BF}=0}$) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 5% and 95% quantiles = 0.39 and 0.67).

Alternative view of stock status and trends

46. China, Japan and Chinese Taipei considered it is not possible to select a base-case model from various sensitivity models in the 2016 assessment, given the advice from the Scientific Service Provider that a suite of the sensitivity models were plausible. Therefore, these members considered that it would be more appropriate to provide advice to WCPFC13 on skipjack stock status based on the range of uncertainty expressed by the alternative model runs in the sensitivity analysis rather than based on the single base case model (represented by the 5% and 95% quantiles of the structural sensitivity grid presented in Table SKJ2).

47. The estimated MSY of the WCPO skipjack stock ranges from 1,618,060 mt (5% quantile) to 2,199,880 mt (95% quantile) across the alternative skipjack stock assessment models represented in the sensitivity grid. These CCMs also noted that some alternative models indicate that the 2015 biomass is below the adopted TRP of $0.5SBF=0$.

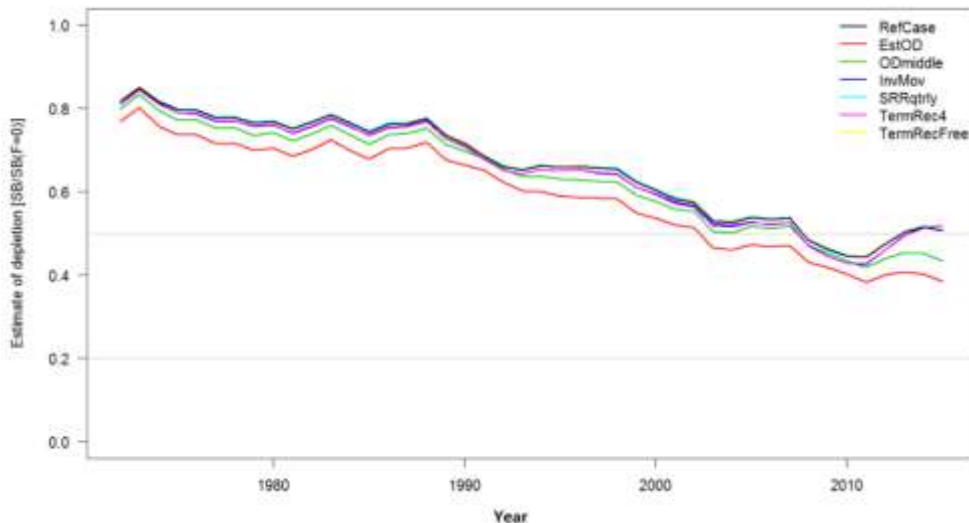


Figure SKJ 7. Estimated fisheries depletion $SB/SBF=0$, for each of the sensitivity models.

Management advice and implications

48. SC12 noted that the skipjack assessment continues to show that the stock is currently moderately exploited and fishing mortality level is sustainable. The recent catches are fluctuating around and some models also indicate that the stock is currently under the TRP.

49. SC12 noted that fishing is having a significant impact on stock size and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack tuna catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

50. SC12 noted that skipjack spawning biomass is now around the adopted TRP and SC12 recommends that the Commission take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.

51. In order to maintain the quality of stock assessments for this important stock, SC12 recommends 1) continued work on developing an index of abundance based on purse seine data; 2) regular large scale tagging cruises and complementary tagging work continue to be undertaken in a way that provides the best possible data for stock assessment purposes.

52. SC12 also notes that the current method of calculating the TRP is based on the most recent 10 years of recruitment information. However, the information on spawning potential, SB_{2015} , which is used to evaluate current stock status relative to the TRP can change very rapidly for skipjack which mature at age 1 and this rapid maturation may provide an optimistic status evaluation when recruitment is estimated have an increasing trend but is estimated with substantial

uncertainty, as is currently observed in the case of skipjack which does not have a fishery-independent index of recruitment strength.

53. There is ongoing concern by at least one CCM that high catches in the equatorial region may be causing a range contraction of WCPO skipjack tuna, thus reducing skipjack tuna availability to fisheries conducted at higher latitudes than the Pacific equatorial region. SC12 reiterates the advice of SC11 whereby there is no demonstrated statistical evidence for SKJ range contraction. As a result, SC12 recommends that ongoing research on range contraction of skipjack tuna be continued in the framework of Project 67.

4.1.4 South Pacific albacore tuna (*Thunnus alalunga*)

Stock status and trends

54. SC12 noted that no stock assessment was conducted for South Pacific albacore tuna in 2016. Therefore, the stock status description from SC11 is still current. For further information on the stock status and trends from SC11, please see <http://www.wcpfc.int/node/26922>.

55. SC12 noted that the total south Pacific albacore catch in 2015 was 68,594 mt, 16% lower than both the catch in 2014 and the average catch for 2010-14.

56. Longline south Pacific albacore catch in 2015 was 17% lower than that in 2014, while troll catch in 2015 was 16% higher than that in 2014.

57. SC12 considered an update of trends in South Pacific albacore fisheries (SC12-SA-WP-06) and noted that there had been some small reductions in southern longline effort in 2014 compared to 2013, but 2015 effort levels are currently considered uncertain. Status quo projections were calculated, assuming current southern longline and troll fishery effort would continue into the future at levels equal to those seen in 2014 (based on the information available to SPC as at 2nd June 2016). Potential future spawning biomass levels relative to unfished levels were examined, and the probability that the south Pacific albacore stock may fall below the biomass Limit Reference Point was calculated.

58. If 2014 fishing effort levels continue into the future, the stock is predicted to continue to decline on average, falling to a projected spawning biomass depletion of $SB_{2033}/SB_{F=0} = 0.32$ in 2033. The risk of falling below the LRP was estimated to be 19%. Furthermore, the CPUE was estimated to decline by 14% from 2013 levels.

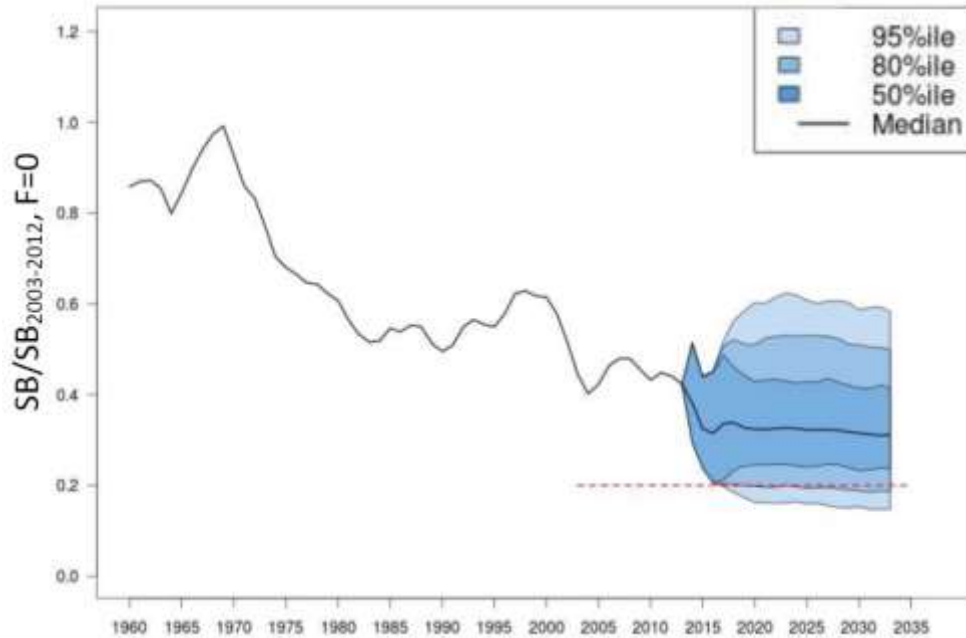


Figure SPA1 (Figure 10 from SC12-SA-WP-06). Stochastic projections of adult stock status under 2014 longline and troll effort levels. The limit reference point (20% SBF=0) is indicated by the horizontal dashed red line. Note that from 1960 up to 2013 inclusive the line represents the median across the 9 assessment model runs (structural uncertainty only); uncertainty after 2013 represents both structural uncertainty and stochastic recruitment.

Management advice and implications

59. SC12 noted that no management advice has been provided since SC11. Therefore, the advice from SC11 should be maintained, that longline fishing mortality and longline catch be reduced to avoid further decline in the vulnerable biomass so that economically viable catch rates can be maintained. SC12 also noted that the results of the indicator analyses supported the stock status results for South Pacific albacore that were obtained from the 2015 assessment.

60. Based on the indicator analysis, SC12 also advised that there is a 19% chance that the south Pacific albacore stock will fall below the Limit Reference Point by 2033 if 2014 fishing effort levels continue, and that overall decreases in vulnerable biomass (a proxy for longline CPUE) of 14% would also be likely to occur.

61. SC12 recommends that the Commission note the information presented on economic conditions in the south Pacific longline fishery. Information in SC12-ST-WP-04 indicated that declining catch rates are contributing to declines in economic conditions that are likely to undermine profitability in the fishery.

62. FFA members noted that this is impacting the viability of their fishing fleets and noted that this reinforces the need for management.

4.2 Northern stocks

4.2.1 North Pacific albacore (*Thunnus alalunga*)

Stock status and trends

63. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific albacore catches is available in the ISC Plenary Report (SC12-GN-IP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

Management advice and implications

64. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.2.2 Pacific bluefin tuna (*Thunnus orientalis*)

Stock status and trends

65. SC12 noted that ISC provided the following conclusions on the stock status of Pacific bluefin tuna in the Pacific Ocean in 2016 presented in SC12-SA-WP-07 (2016 Pacific Bluefin Tuna Stock Assessment):

The PBFWG conducted a benchmark assessment (base-case model) using the best available fisheries and biological information. The base-case model fits well the data that were considered to be more reliable and is internally consistent among most of the sources of data. The 2016 base-case model is a substantial improvement compared to the 2014 assessment and fits all reliable data well. The base-case model indicates: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2014) and (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The model diagnostics suggest that the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations.

Using the base-case model, the 2014 (terminal year) SSB was estimated to be around 17,000 t (Figure 7-4), which is about 9,000 t below the terminal year estimated in the 2014 assessment (26,000 in 2012). This is because of improvements to the input data and refinements to the assessment model scaled down the estimated value of SSB and not because the SSB declined from 2012 to 2014.

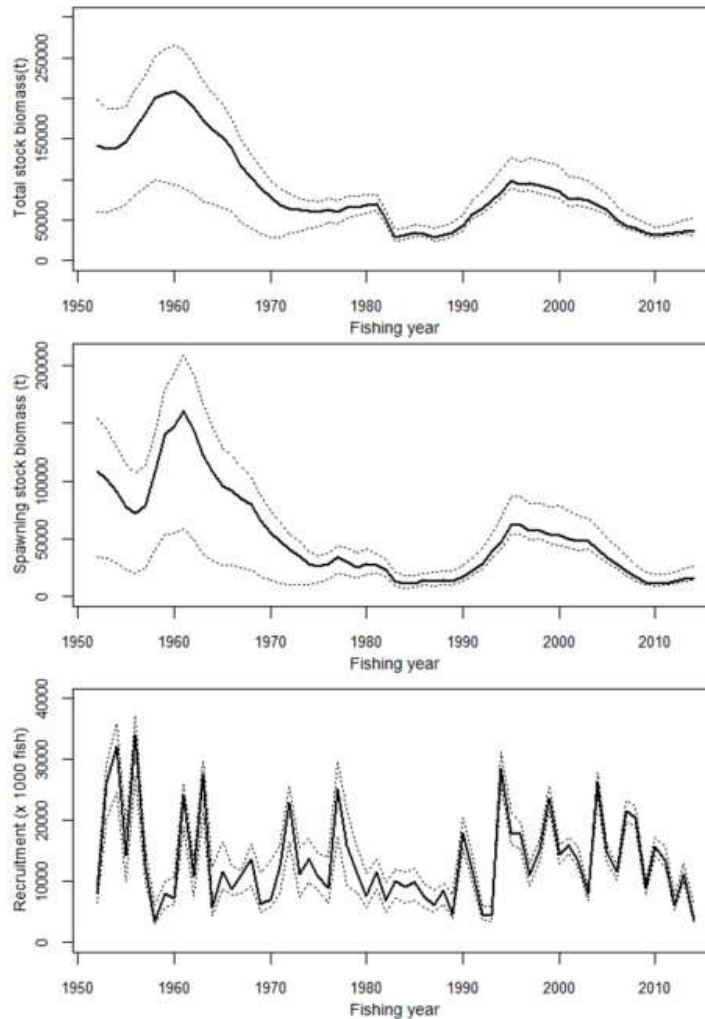


Figure 7-4. Total stock biomass (top), spawning stock biomass (middle) and recruitment (bottom) of PBF from the base-case model. The solid line indicates point estimate and dashed lines indicate the 90% confidence interval.

Recruitment estimates fluctuate widely without an apparent trend. The 2014 recruitment was relatively low, and the average recruitment for the last five years may have been below the historical average level (Figure 7-4). Note that recruitments in terminal years in an assessment are highly uncertain due to limited information on the cohorts. However, two of the last three data points from the Japanese troll CPUE-based index of recruitment, which was consistent with other data in the model, are at their lowest level since the start of the index (1980). Estimated age-specific fishing mortalities on the stock during 2011-2013 and 2002-2004 (the base period for WCPFC CMM 2015-04) are presented in Figure 7-5. Most age-specific fishing mortalities (F) for intermediate ages (2-10 years) are substantially above F₂₀₀₂₋₂₀₀₄ while those for age 0 as well as ages 11 and above are lower (Table 7-1).

Table 7-1. Percent change of estimated age-specific fishing mortalities of PBF from 2002-2004 to 2011-2013.

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
change from F ₂₀₀₂₋₂₀₀₄ to F ₂₀₁₁₋₂₀₁₃	-28%	-1%	+96%	+4%	+86%	+43%	-9%	+81%	+21%	+23%	+5%	-5%	-7%	-8%	-9%	-10%	-10%	-10%	-11%	-11%	-11%

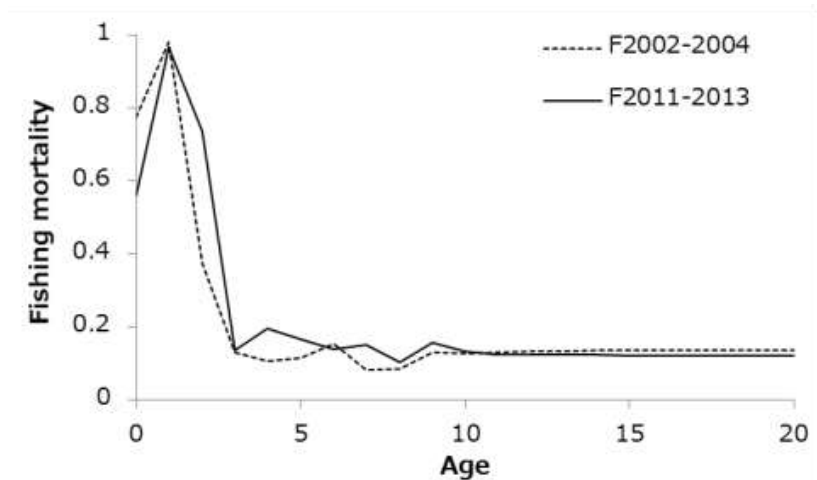


Figure 7-5. Geometric means of annual age-specific (years) fishing mortalities of PBF for 2002-2004 (dashed line) and 2011-2013 (solid line).

Although no limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the $F_{2011-2013}$ exceeds all calculated biological reference points except for FMED and FLOSS despite slight reductions to F in recent years (Table 7-2). The ratio of SSB in 2014 relative to the theoretical unfished¹ SSB ($SSB_{2014}/SSB_{F=0}$, the depletion ratio) is 2.6%² and $SSB_{2012}/SSB_{F=0}$ is 2.1% indicating a slight increase from 2012 to 2014. Although the $SSB_{2014}/SSB_{F=0}$ for this assessment (2.6%) is lower than $SSB_{2012}/SSB_{F=0}$ from the 2014 assessment (4.2%), this difference is due to improvements to the input data and model structure (Figure 7-4) rather than a decline in SSB from 2012 to 2014. Note that potential effects on Fs as a result of the measures of the WCPFC and IATTC starting in 2015 or by other voluntary measures are not yet reflected in the data used in this assessment.

Since reference points for PBF have yet to be identified, two examples of Kobe plots (Figure 7-6: plot A based on SSBMED and FMED, plot B based on SSB20% and SPR20%) are presented. These versions of the Kobe plot represent two interpretations of stock status in an effort to prompt further discussion. In summary, if these were the reference points, overfishing would be occurring or just at the threshold in the case of FMED; and the stock would be considered overfished. Plot B shows that the stock has remained in an overfished and overfishing status for the vast majority of the assessment period if $F_{20\%}$ and $SSB_{20\%}$ are the reference points. The ISC notes that the SSB estimates before 1980 are more uncertain and that the reason why the fishing mortality is estimated to be so high right after the WWII is not well understood. The low biomass level at the beginning of the assessment period (1952) could potentially be the result of relatively high catches prior to the assessment period of PBF.

¹ “Unfished” refers to what SSB would be had there been no fishing.

² The unfished SSB is estimated based upon equilibrium assumptions of no environmental or density-dependent effects.

Table 7-2. Ratios of the estimated fishing mortalities F2002-2004, F2009-2011 and F2011-2013 relative to computed F- based biological reference points and SSB (t) and depletion ratio for the terminal year of the reference period for PBF.

	F_{max}	$F_{0.1}$	F_{med}	F_{loss}	$F_{10\%}$	$F_{20\%}$	$F_{30\%}$	$F_{40\%}$	Estimated SSB for terminal year of each reference period	Depletion ratio for terminal year of each reference period
2002-2004	1.86	2.59	1.09	0.80	1.31	1.89	2.54	3.34	41,069	0.064
2009-2011	1.99	2.78	1.17	0.85	1.41	2.03	2.72	3.58	11,860	0.018
2011-2013	1.63	2.28	0.96	0.70	1.15	1.66	2.23	2.94	15,703	0.024

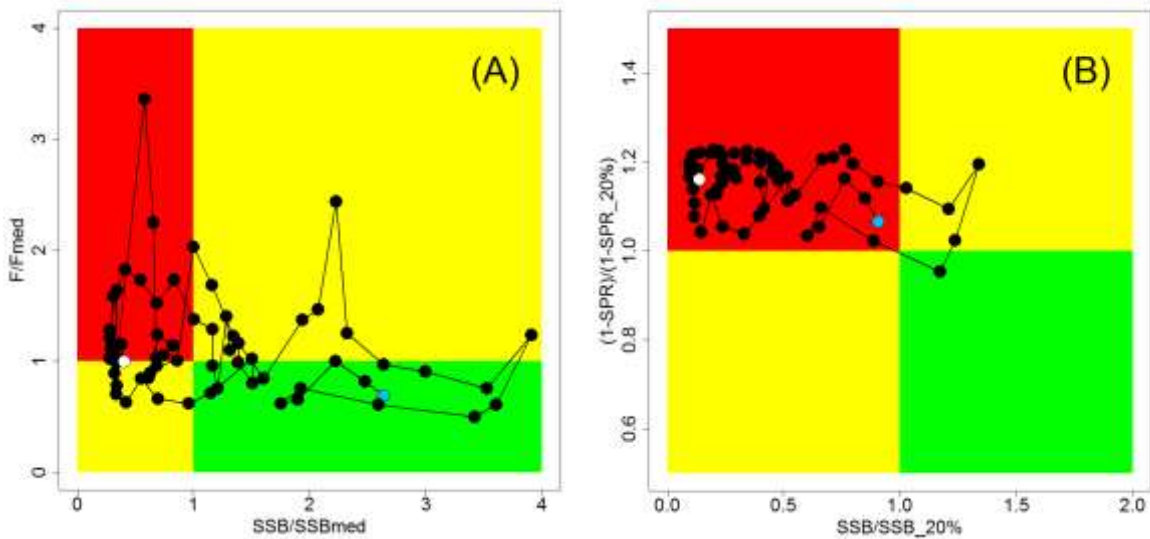


Figure 7-6. Kobe plots for PBF. (A) SSBMED and FMED; (B) SSB20% and SPR20% based. Note that SSBMED is estimated as the median of estimated SSB over whole assessment period (40,944 t) and FMED is calculated as an F to provide SSBMED in long-term, while the plots are points of estimates. The blue and white points on the plot show the start (1952) and end (2014) year of the period modelled in the stock assessment, respectively.

Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish³ (age 0-1), have had a greater impact, and the effect of these fleets in 2014 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period (Figure 7-7). This is because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

³ It was noted that the term small fish is not used in CMM 2015-04; however, the measure states “Further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered...”

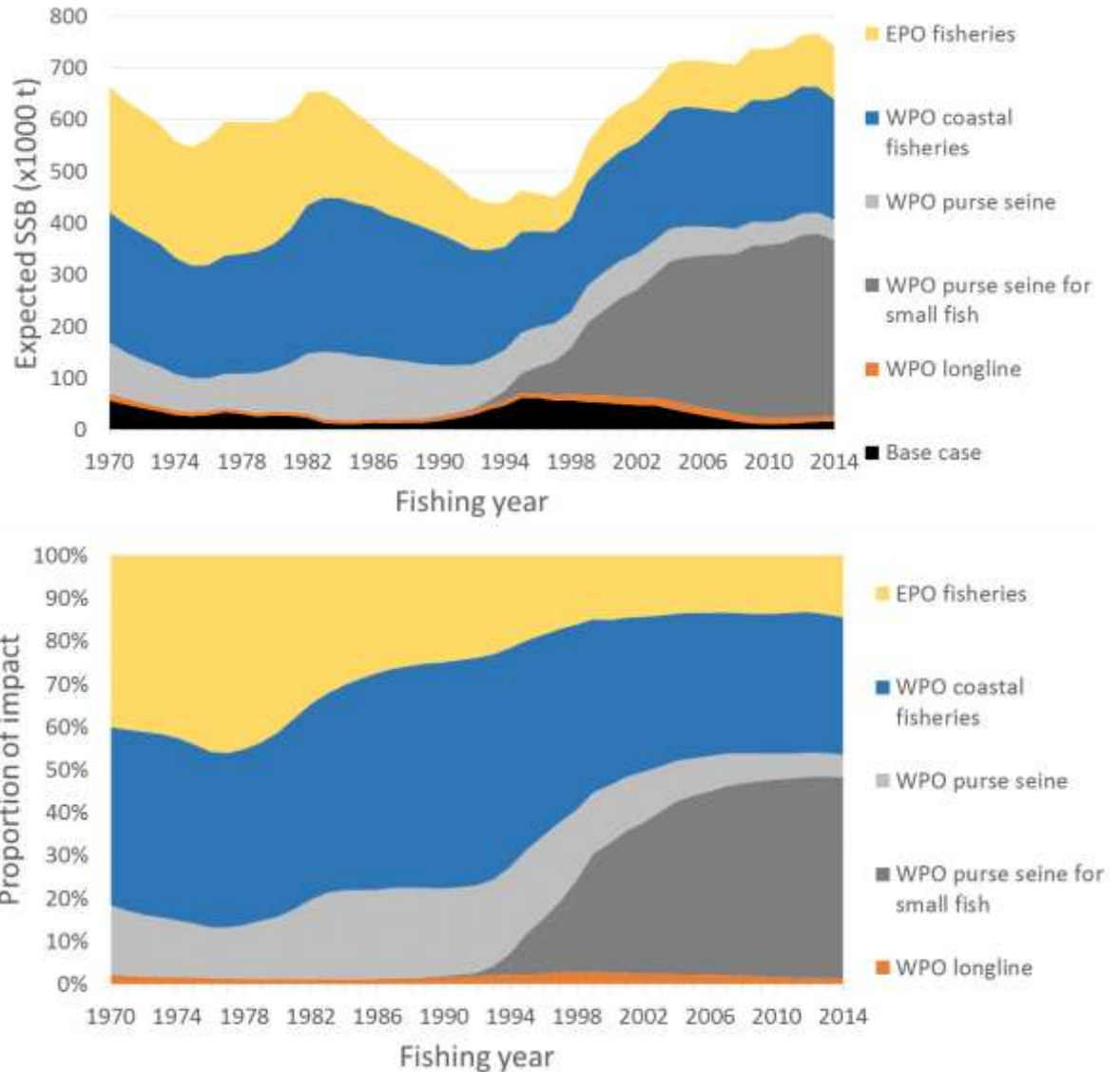


Figure 7-7. Trajectory of the spawning stock biomass of a simulated population of PBF when zero fishing mortality ($F=0$) is assumed and the STET at $F=0$ is the same as estimated in the base-case assessment model, estimated by the base-case model. (Top: absolute impact, bottom: relative impact). Fleet definition; WPO longline: F1, F12, F17. WPO purse seine for small fish: F2, F3, F18. WPO purse seine: F4, F5. WPO coastal fisheries: F6-11, F16, F19. EPO fisheries: F13, F14, F15.

66. In the absence of any agreed definition of a drastic drop in stock recruitment referred to in CMM 2015-04, SC12 notes with concern that the 2012 and 2014 recruitments are at the lowest levels observed since 1980, noting that ISC noted that recruitment in the terminal years of any assessment is highly uncertain. SC12 also noted a comment from Japan that some indices of 2015 recruitment are above the 2014 level and early anecdotal information regarding the 2016 recruitment suggests it is not particularly low.

67. The provisional total Pacific Bluefin tuna catch in 2015 was 11,020 mt in the North Pacific Ocean, which was a 36% decrease over 2014 and a 30% decrease over the average for 2010-2014.

68. SC12 noted that, based on the latest stock assessment carried out by ISC in 2016, SC12 noted that the Pacific bluefin tuna spawning stock biomass is depleted to 2.6% of the estimated unfished spawning stock biomass (SBF=0). SC12 emphasized that this depletion level is considerably below the biomass depletion-based Limit Reference Point of 20% of SBF=0 set by the Commission for all other WCPFC key tuna stocks (skipjack, yellowfin, bigeye, south Pacific albacore and north Pacific albacore). However, SC12 also notes that the Pacific bluefin tuna stock remained below 20% of SBF=0 for most of the time of assessment. SC12 also noted that the initial rebuilding target currently defined by the CMM 2015-04, the median of the SSB of the stock assessment period (42,582 mt) corresponds to a spawning biomass of around 7% of estimated unfished spawning stock biomass.

Management advice and implications

69. SC12 noted the following conservation advice from ISC:

The steady decline in SSB from 1996 to 2010 appears to have ceased, although SSB2014 is near the historic low and the stock is experiencing exploitation rates above all calculated biological reference points except for FMED and FLOSS.

The projection results based on the base-case model under several harvest and recruitment scenarios and time schedules are shown in Table 7-3 and Figure 7-8. Under all examined scenarios the initial goal of WCPFC, rebuilding to SSBMED by 2024 with at least 60% probability, is reached and the risk of SSB falling below SSBLOSS at least once in 10 years was low.

The projection results indicate that the probability of SSB recovering to the initial WCPFC target (SSBMED by 2024, 38,000 t, calculated in the same manner as the previous assessment) is 69% or above the level prescribed in the WCPFC CMM if low recruitment scenario is assumed and WCPFC CMM 2015-04 and IATTC Resolution C-14-06 continue in force and are fully implemented (Table 4: Scenario 2 with low recruitment).

The ISC notes there are technical inconsistencies in the calculation of SSBMED in the assessment and projection. The ISC also notes the current calculation of SSBMED in the projection includes the most recent estimates of SSB and unless a fixed period of years is specified to calculate SSBMED, the calculation of SSBMED could be influenced by future trends in spawning biomass. The ISC therefore recommends defining SSBMED as the median point estimate for a fixed period of time, either, 1952-2012 or 1952-2014. If 1952-2012 is chosen, then SSBMED is estimated to be 41,069 t, and if 1952-2014 is chosen, SSBMED is 40,994 t. The probabilities of achieving 41,000 t under various scenarios are provided in Table 7-3. The probabilities of achieving 43,000 t, where WCPFC CMM 2015-04's initial rebuilding target is specified as 42,592 t, are also provided in Table 7-3, although this value is derived from the previous assessment and is higher than the SSBMED calculated in the current assessment. The ISC recommends that in the future absolute values should not be used for the initial rebuilding target, as the calculated values of reference points would change from assessment to assessment.

Scenario 2 with low recruitment has the lowest prospect of recovery among the examined harvest scenarios. The probability of achieving the WCPFC's initial target (SSBMED by 2024) would increase if more conservative management measures were implemented as shown in Table 7-3 and Figure 7-8. The projection results indicate that a 10% reduction in the catch limit for fish smaller than the weight threshold in CMM 2015-04 would have a larger effect on recovery than a 10% reduction in the catch limit for fish larger than the weight threshold. (Figure 7-8 (D)). The ISC notes that the current assessment model uses a maturity ogive that assumes 20%, 50% and 100% maturity in age 3 (weight on July 1: 34kg), 4 (weight on July 1: 58kg) and 5 (weight on July 1: 85kg), respectively, while the WCPFC CMM 2015-04 specifies that catches of fish smaller than 30kg should be reduced. The weight threshold in the CMM needs to be increased to

85kg (weight of age 5) if the intent is to reduce catches on all juveniles according to the maturity ogive in the assessment.

The projections results assuming a stronger stock-recruitment relationship (where $h=0.9$) than in the assessment model are not necessarily more pessimistic than the low recruitment scenario. The projection results assume that the CMMs are fully implemented and are based on certain biological or other assumptions. In particular, the ISC noted the implementation of size based management measures need to be monitored carefully. If conditions change, the projection results would be more uncertain. Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

Table 7-3. Future projection scenarios for PBF and their probability of achieving various target levels by various time schedules based on the base-case model.

Harvesting Scenario #	Fishing mortality	Catch limit *		Threshold of Small/Large	Recruitment scenario **	Probability that SSB exceeds 38,000 tons (SSB median of Bootstrap analysis runs)			Probability that SSB exceeds 41,000 tons (SSB median of Base case model) ***			Probability that SSB is more than 43,000 tons (SSBmed@last assessment)			Probability that SSB is more than 10% SSB0			Probability that SSB is more than 20% SSB0			Average Catch	
		Small	Large			2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2019	2024
		Scenario1	scenario 6 in 2014 assessment			30 kg	Low recruitment	77.0%	83.8%	89.9%	69.7%	83.3%	85.2%	64.3%	79.3%	81.9%	14.7%	28.0%	31.8%	0.0%	0.0%	0.1%
Scenario2	50% of 2002-2004 average catch for WFO fisheries 3,300 tons for EPO commercial fisheries 2002-2004 average catch for WFO fisheries		Average recruitment	69.3%	83.7%		86.6%	61.5%	77.8%	82.3%	56.1%	73.9%	79.0%	13.6%	29.3%	35.4%	0.1%	0.4%	0.6%	11749.7	12994.2	
			Stock Recruit Relationship w/ $h=0.9$	99.6%	100%		100%	99.3%	100%	100%	99.3%	100%	100%	96.3%	99.3%	100%	73.8%	95.0%	98.0%	12958.4	14730.8	
			Low recruitment	98.2%	99.8%		99.9%	97.7%	99.8%	99.9%	97.2%	99.7%	99.9%	95.5%	99.4%	99.9%	72.0%	97.3%	99.6%	13087.3	15020.1	
Scenario3	F2002-2004	50% of 2002-2004 average catch		50 kg	Low recruitment	80.5%	91.5%	94.0%	73.3%	87.9%	90.7%	69.1%	85.1%	88.5%	22.2%	43.6%	51.7%	0.2%	0.9%	1.3%	11404.4	12672.3
Scenario4				80 kg	Low recruitment	86.4%	94.6%	96.2%	80.6%	91.9%	94.7%	76.6%	90.0%	93.0%	27.8%	51.8%	61.3%	0.2%	1.1%	1.6%	11292.6	12542.7
Scenario5		90% of scenario 2 same as Scenario 2		30 kg	Low recruitment	90.0%	96.5%	98.1%	83.3%	94.8%	97.0%	81.5%	93.4%	95.9%	35.0%	61.7%	70.4%	0.3%	2.5%	3.7%	11306.4	12881.3
					Average recruitment	99.9%	100%	100%	99.9%	100%	100%	99.9%	100%	100%	98.4%	100%	100%	82.2%	97.3%	99.3%	12442.0	14126.3
					Stock Recruit Relationship w/ $h=0.9$	99.4%	100%	100%	99.2%	100%	100%	99.1%	100%	100%	97.0%	99.8%	100%	81.8%	99.0%	99.9%	12576.4	14448.2
					Low recruitment	75.3%	88.2%	90.2%	67.2%	82.9%	86.5%	61.7%	78.6%	83.4%	15.7%	32.5%	38.7%	0.1%	0.5%	0.7%	11496.2	12632.4
Scenario6		same as Scenario 2 90% of scenario 2		Average recruitment	99.7%	100%	100%	99.6%	100%	100%	99.2%	100%	100%	96.3%	99.9%	100%	75.1%	95.2%	98.1%	12686.3	14071.5	
				Stock Recruit Relationship w/ $h=0.9$	98.9%	99.9%	100%	98.6%	99.9%	100%	98.4%	99.9%	100%	95.0%	99.7%	100%	75.5%	98.0%	99.9%	12761.0	14379.7	
Scenario7		90% of scenario 2		Low recruitment	90.3%	96.8%	98.3%	86.2%	95.4%	97.6%	82.7%	94.2%	96.8%	39.4%	68.0%	77.4%	0.3%	3.5%	5.6%	11231.0	12607.1	
				Average recruitment	99.9%	100%	100%	99.9%	100%	100%	99.9%	100%	100%	98.5%	100%	100%	83.5%	98.1%	99.6%	12139.4	13461.7	
				Stock Recruit Relationship w/ $h=0.9$	99.2%	100%	100%	99.1%	100%	100%	99.0%	99.9%	100%	96.9%	99.3%	100%	81.6%	99.0%	99.9%	11227.3	12461.8	
Scenario8	80% of scenario 2 same as Scenario 2		Low recruitment	97.5%	99.6%	99.9%	96.1%	99.3%	99.7%	94.8%	98.9%	99.5%	65.4%	89.2%	94.0%	1.9%	14.5%	22.8%	10922.8	12688.4		
Scenario9	same as Scenario 2 80% of scenario 2		Low recruitment	78.1%	89.8%	92.5%	70.4%	85.6%	88.8%	65.0%	81.9%	86.3%	18.4%	37.1%	44.7%	0.2%	0.6%	0.9%	11327.0	12329.9		
Scenario10	80% of scenario 2		Low recruitment	98.3%	99.8%	99.9%	97.4%	99.6%	99.9%	96.3%	99.5%	99.8%	73.2%	93.8%	97.5%	3.1%	22.4%	34.1%	10585.9	11586.4		
			Average recruitment	100%	100%	100%	100%	100%	100%	100%	100%	100%	99.7%	100%	100%	91.0%	99.5%	100%	11194.1	12104.9		
			Stock Recruit Relationship w/ $h=0.9$	99.8%	100%	100%	99.7%	100%	100%	99.7%	100%	100%	98.7%	100%	100%	90.0%	99.7%	100%	11227.3	12461.8		
Scenario11	F2011-2013	same as Scenario 2 same as Scenario 2		Low recruitment	82.6%	93.0%	95.0%	75.9%	89.9%	92.1%	71.3%	86.4%	89.9%	23.6%	46.2%	56.0%	0.1%	1.2%	1.6%	12266.8	13587.4	

* Catch limits for EPO commercial fisheries is applied for all the catch (small and large fish) made by the Fleets.

** Average recruitment refers to the recruitment for the whole assessment period while low recruitment refers to that of 1980-1989.

*** Probability that SSB exceeds 41,000 tons (SSB median of Base case model) developed by PBFWG at ISC16 Plenary.

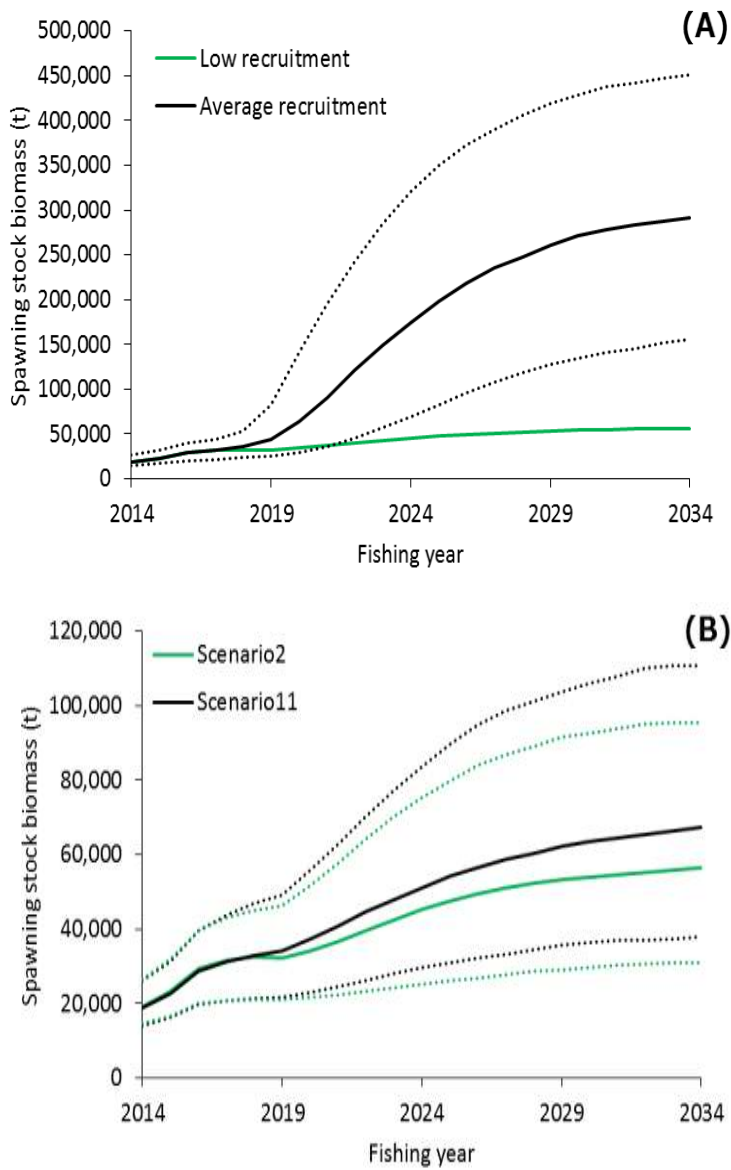


Figure 7-8. Comparisons of various projection results for PBF. (A) Low recruitment vs. historical average recruitment (Scenario 2). (B) Current CMMs (Scenario 2) vs. current F (Scenario 11) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval.

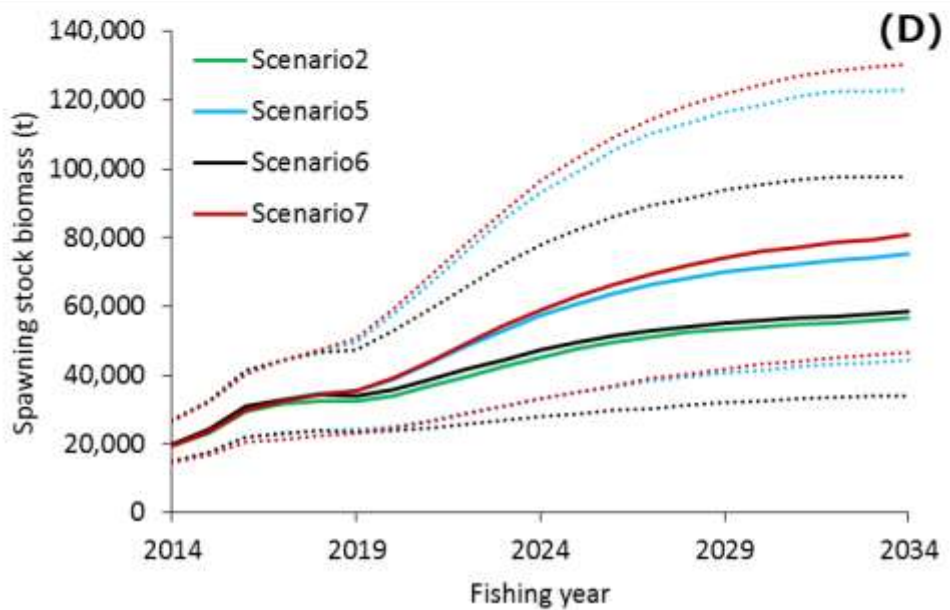
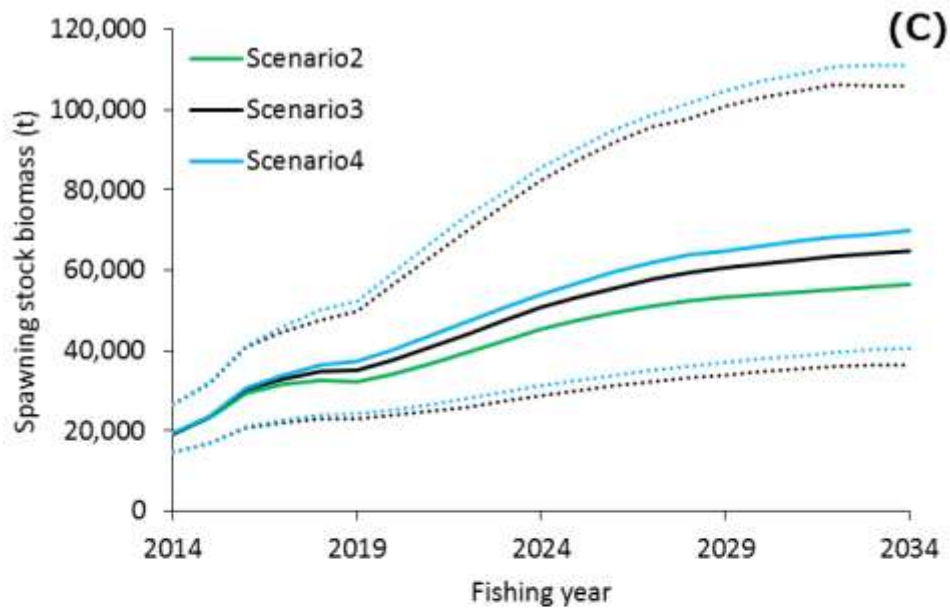


Figure 7-8 (cont.). Comparisons of various projection results for PBF. (C) Different definition of small fish (30kg (Scenario 2) vs. 50kg (Scenario 3) vs. 80kg (Scenario 4)) (low recruitment). (D) Current CMMs (Scenario 2) vs. additional 10% catch limit reduction for small fish (Scenario 5), for large fish (Scenario 6) and for all fish (Scenario 7) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval.”

70. SC12 advised WCPFC13 that FFA members expressed concern that the substantial depletion of the Pacific bluefin stock due to excess fishing in the northern WCPFC region has probably resulted in range contraction, thus greatly reducing the availability of bluefin tuna (*Thunnus orientalis*) in the south Pacific. This is of particular significance to Pacific island CCMs

because it limits their future opportunities for the participation in fisheries for this stock. SC12 also noted no statistical demonstration is provided to support the range contraction of Pacific Bluefin tuna. SC12 noted the need for additional information.

71. In view of the upcoming IATTC-WCPFC joint meeting on Pacific bluefin tuna management, SC12 expressed the need of urgent coordinated actions between WCPFC and IATTC in reviewing the current rebuilding plan, establishing the emergency rule as well as considering and developing reference points and HCRs for the long term management of PBF.

4.2.3 North Pacific swordfish (*Xiphias gladius*)

Stock status and trends

72. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific ~~albacore~~ swordfish catches is available in the ISC Plenary Report (SC12-GN-WP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

Management advice and implications

73. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.3 WCPO sharks

4.3.1 Oceanic whitetip shark (*Carcharhinus longimanus*)

Stock status and trends

74. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

75. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.2 Silky shark (*Carcharhinus falciformis*)

Stock status and trends

76. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic

whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

77. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.3 South Pacific blue shark (*Prionace glauca*)

Stock status and trends

78. SC12 noted that WCPFC has not yet determined limit biological reference points for South Pacific blue shark.

79. SC12 noted that the stock status for shark assessments presented to the Scientific [Committee](#) have been traditionally assessed relative to MSY-based reference points. It was also noted that realistic estimates of equilibrium unexploited recruitment and spawning biomass could not be obtained in the 2016 South Pacific blue shark assessment due to the lack of available data, conflicting CPUE time series, and uncertainty in the estimated stock recruitment relationship.

80. SC12 noted that the 2015 catch of south Pacific blue shark provided within aggregate 5-degree square catch data was 26% lower than in 2014, and a 34% reduction over the average for 2010-14.

81. SC12 noted that the 2016 South Pacific blue shark assessment is preliminary and is considered to be a work in progress. As a result, it cannot be used to determine stock status and form the basis of management advice.

82. SC12 noted that there are a number of data uncertainties within the South Pacific blue shark assessment, especially with regard to historical and contemporary longline catch and CPUE estimates. The data-poor nature of the South Pacific blue shark assessment indicates that an improvement in the amount and quality of available biological and fishery information will be required in order to develop a useful integrated stock assessment model.

83. SC12 noted the recommendations in the working papers (SC12-SA-WP-08 and SC12-SA-WP-09) for data improvements and other analytical work needed to improve the assessment for South Pacific blue shark, and recommends prioritizing such work.

Management advice and implications

84. SC12 noted that no management advice has been provided for South Pacific blue shark.

4.3.4 North Pacific blue shark (*Prionace glauca*)

Stock status and trends

85. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic

whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

86. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.5 North Pacific shortfin mako (*Isurus oxyrinchus*)

Stock status and trends

87. SC12 noted that there is no existing stock assessment for North Pacific shortfin mako shark.

Management advice and implications

88. SC12 noted that no management advice has been provided for North Pacific shortfin mako shark.

4.3.6 Pacific bigeye thresher shark (*Alopias superciliosus*)

Stock status and trends

89. SC12 noted that there is no existing stock assessment for Pacific bigeye thresher shark but acknowledged the submission of SC12-SA-IP-17 which represents the initial chapters of a stock assessment currently in preparation.

90. SC12 noted that, although it was planned that the bigeye thresher shark assessment would be presented to and reviewed by SC12, the full assessment report could not be completed in time and is currently being finalized by the consultants, the WCPFC Secretariat, the SPC (on behalf of some of their members), the United States and Japan. SC12 understands that the finalized bigeye thresher assessment report will be posted on the ABNJ Tuna Project website when ready, and then provided to SC13 for discussion.

Management advice and implications

91. SC12 noted that no management advice has been provided for Pacific bigeye thresher shark.

4.4 WCPO billfishes

4.4.1 South Pacific swordfish (*Xiphias gladius*)

Stock status and trends

92. SC12 noted that no stock assessment was conducted for South Pacific swordfish in 2015. Therefore, the stock status description from SC9 is still current.

Management advice and implications

93. SC12 noted that no management advice had been provided since SC9. Therefore, the advice from SC9 should be maintained.

4.4.2 Southwest Pacific striped marlin (*Kajikia audax*)

Stock status and trends

94. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

95. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.3 North Pacific striped marlin (*Kajikia audax*)

Stock status and trends

96. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

97. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.4 Pacific blue marlin (*Makaira nigricans*)

Stock status and trends

98. SC12 noted the stock status for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

Estimates of total BUM stock biomass show a long term decline. Population biomass (age-1 and older) averaged roughly 130,965 t in 1971-1975, the first 5 years of the assessment time frame, and has declined by approximately 40% to 78,082 t in 2014 (Figure 7-11). Female spawning biomass was estimated to be 24,809 t in 2014, or about 25% above SSBMSY (Table 7-3 and Table 7-4). Fishing mortality on the stock (average F, ages 2 and older) averaged roughly $F = 0.28$ during 2012-2014, or about 12% below FMSY. The estimated spawning potential ratio of the stock (SPR, the predicted spawning output at the current F as a fraction of unfished spawning output) is currently

SPR2012-2014 = 21%. Annual recruitment averaged about 897,000 recruits during 2008-2014, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates indicate a long-term decline in spawning stock biomass and suggest a fluctuating pattern without trend for recruitment (Figure 7-11).

Table 7-3. Reported catch (t) used in the stock assessment along with annual estimates of population biomass (age-1 and older, t), female spawning biomass (t), relative female spawning biomass (SSB/SSBMSY), recruitment (thousands of age-0 fish), fishing mortality (average F, ages-2 and older), relative fishing mortality (F/FMSY), and spawning potential ratio of Pacific blue marlin.

Year	2008	2009	2010	2011	2012	2013	2014	Mean ¹	Min ¹	Max ¹
Reported Catch	17,828	18,282	20,086	18,165	19,407	20,727	20,356	18,232	9,160	25,589
Population Biomass	71,768	69,720	72,696	72,995	76,697	78,761	78,082	101,149	69,720	135,623
Spawning Biomass	22,706	23,065	22,392	23,182	23,432	24,771	24,809	41,717	20,972	71,807
Relative Spawning Biomass	1.14	1.16	1.13	1.17	1.18	1.25	1.25	2.10	1.06	3.62
Recruitment (age 0)	687	1031	702	1061	763	909	839	897	589	1181
Fishing Mortality	0.27	0.29	0.30	0.26	0.27	0.28	0.28	0.22	0.09	0.38
Relative Fishing Mortality	0.82	0.88	0.92	0.82	0.83	0.87	0.87	0.67	0.26	1.17
Spawning Potential Ratio	22%	21%	20%	22%	22%	21%	21%	31%	15%	51%

¹ During 1971-2014

Table 7-4. Estimates of biological reference points along with estimates of fishing mortality (F), female spawning stock biomass (SSB), recent average yield (C), and spawning potential ratio (SPR) of BUM, derived from the base case model assessment model, where “MSY” and “20%” indicate reference points based on maximum sustainable yield and a spawning potential ratio of 20%, respectively.

Reference Point	Estimate
F _{MSY} (age 2+)	0.32
F20% (age 2+)	0.30
F2012-2014 (age 2+)	0.28
SSBMSY	19,853 mt
SSB20%	22,727 mt
SSB2014	24,809 mt
MSY	19,901 mt
C2012-2014	20,163 mt
SPRMSY	0.18
SPR2012-2014	0.21

Note: SSB values represent female spawning biomass only.

The Kobe plot depicts the stock status relative to MSY-based reference points for the base case model (Figure 7-12) and shows that spawning stock biomass decreased to roughly the MSY level in the mid-2000s, and has increased slightly in recent years (Table 7-4 and Figure 7-11). Based on the results of this 2016 stock assessment update, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing. Because Pacific blue marlin is mainly caught as bycatch, direct control of the annual catch amount through the setting of a total allowable catch may be difficult.”

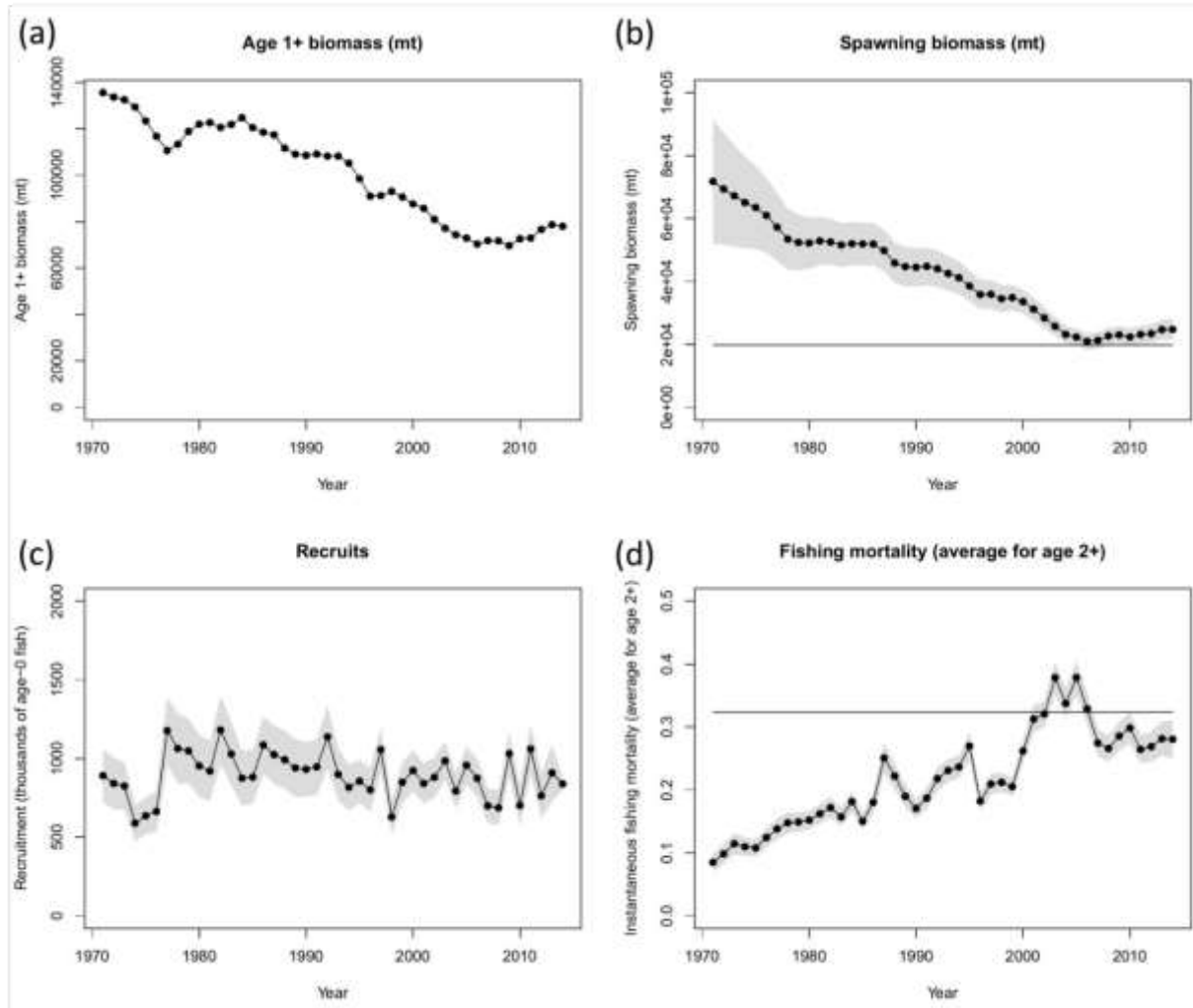


Figure 7-11. Time series of estimates of (a) population biomass (age 1+), (b) female spawning biomass, (c) recruitment (age-0 fish), and (d) instantaneous fishing mortality (average for age 2+, year-1) for BUM derived from the 2016 stock assessment update. The solid circles represents the maximum likelihood estimates by year for each quantity and the shadowed area represents the uncertainty of the estimates (± 1 standard deviation), except for the total biomass time series. The solid horizontal lines indicate the MSY- based reference points for spawning biomass and fishing mortality.

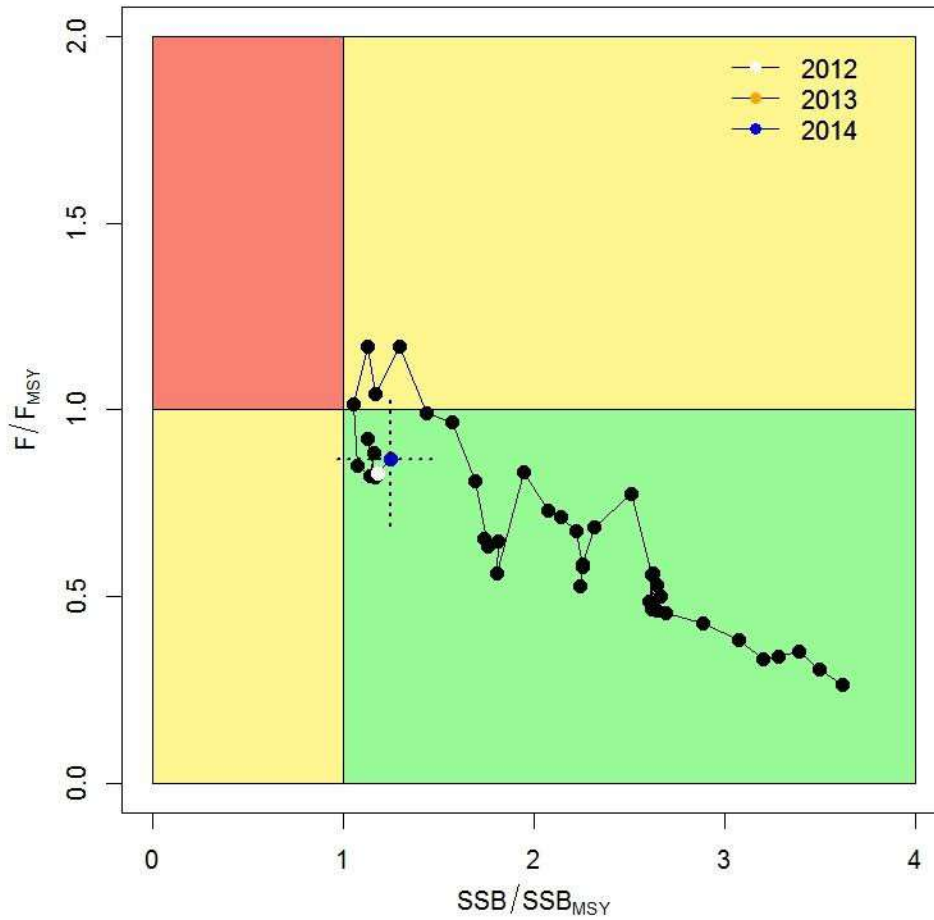


Figure 7-12. Kobe plot of the time series of estimates of relative fishing mortality (average of age 2+) and relative spawning stock biomass of BUM during 1971-2014. The dashed lines denote the 95% confidence intervals for the estimates in the year 2014.

Management advice and implications

99. SC12 noted the conservation advice for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

Since the stock is nearly full exploited, the ISC recommends that fishing mortality remain at or below current levels (2012-2014).

AGENDA ITEM 5 – MANAGEMENT ISSUES THEME

5.1 Development of harvest strategy framework

5.1.1 Management objectives

100. SC12 noted that the Commission is scheduled to ‘record’ the management objectives for each fishery or stock (south-Pacific albacore, skipjack, yellowfin and bigeye) in 2016. Noting the direct relationship between management objectives, and the need to identify performance indicators within the Management Strategy Evaluation (MSE) currently being developed, SC12 encourage WCPFC13 to provide additional clarity on the management objectives for skipjack and south-Pacific albacore.

5.1.2 Reference points

a. South Pacific albacore

101. SC12 reviewed information related to the biological and economic consequences of alternative catch trajectories to achieve a candidate south Pacific albacore target reference point (SC12-MI-WP-01) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the biological and economic consequences of the various trajectory options modelled in this paper in making a decision on an appropriate target reference point for south Pacific albacore. In particular, SC12 draws the attention of WCPFC13 to the importance of assumptions on key bycatch species catch levels for economic estimates; and the need to include additional economic losses due to the exit of vessels from the fishery.

b. Bigeye tuna

102. SC12 reviewed information related to biologically reasonable rebuilding timeframes for bigeye tuna (SC12-MI-WP-02) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the various options modelled in this paper in making a decision on an appropriate rebuilding timeframe for bigeye tuna. In particular, SC12 draws the attention of WCPFC13 to i) the estimated bigeye generation time of 4 years, and minimum rebuilding time in the absence of fishing of 2-4 years, ii) that consideration of acceptable risk for the bigeye stock falling below the limit reference point will influence the findings, and iii) it will be important to examine not only the timeframe but also the stock trajectory of rebuilding.

5.1.3 Implications of alternative levels of acceptable risk

103. SC12 reviewed a proposal for adopting interim acceptable levels of risk for breaching limit reference points in the WCPO (SC12-MI-WP-03) and provided a number of suggestions to clarify aspects of the rationale within the paper before a revised version is forwarded to WCPFC13. Noting that WCPFC13 is scheduled to agree levels of risk for the four key tuna species, SC12 recommended that WCPFC13 take into consideration the rationale outlined in this paper for identifying acceptable levels of risk and again notes that the UN Fish Stocks Agreement states that the risk of exceeding LRPs should be very low. SC12 also recommends that adopted risk levels be seen as interim and be reviewed in light of the outcomes of the Management Strategy Evaluation work-plan. SC12 recommended that WCPFC13 notes that levels of risk for breaching LRP should be considered coupled with the corresponding conservative or liberal nature of the LRP. For example, the bigeye tuna LRP (20% of unfished spawning biomass) is very close to the depletion expected to occur (0.21) if the fishery attained the spawning biomass at MSY. Therefore the bigeye

tuna LRP is viewed as conservative and could have associated higher levels of risk for breaching the LRP.

5.1.4 – 5.1.5 Performance indicators and Monitoring strategy

104. SC12 reviewed candidate performance indicators and monitoring strategies for skipjack and South Pacific albacore commensurate with candidate management objectives for the tropical purse seine and southern longline fisheries (SC12-MI-WP-04) and provided a number of suggestions to clarify aspects of the paper and expand on the list of performance indicators before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the candidate performance indicators and monitoring strategies listed in this paper, and noting that the number of key performance indicators should be kept to a tractable level, provide advice on what performance indicators and monitoring strategies should be included for the development of harvest strategies under CMM 2014-06.

5.1.6 Harvest control rules and management strategy evaluation

105. SC12 reviewed the report of the expert consultation held at SPC in June 2016 on the development of a management strategy evaluation framework for WCPFC tuna stocks (SC12-MI-WP-05). SC12 endorsed the scope of the work to be undertaken as outlined in this report and recommended that i) while a model-based management strategy may be appropriate for skipjack, the concern of the workshop was on the future availability of abundance indices and tagging data for skipjack and WCPFC13 should consider how these necessary data can continue to be provided to support the assessment and MSE, and ii) that both empirical and model-based management strategies could be tested for South Pacific albacore but that CPUE based methods may be dependent on access to operational longline logbook data.

106. SC12 also recommended that WCPFC13 support the recommendation of the MSE workshop for the continued involvement of experts to provide technical advice on the MSE work as well as a process for ongoing science and management dialogue to facilitate stakeholder involvement in the development of harvest strategies. The SC12 considers both of these additional processes are essential for completion of the harvest strategies work-plan under CMM 2014-06, with separate consideration required for each of the species included in this work-plan. SC12 recommends that expert technical advice to the Scientific Service Provider be facilitated via informal meetings and/or workshops similar to the arrangements for the annual Pre-Assessment Workshop. With respect to science and management dialogue, SC12 recommended that stakeholder involvement should be undertaken via in-country stakeholder engagement with the Scientific Service Provider together with a higher-level meeting or workshop for broader stakeholder engagement (to be held as needed) to finalise input to the MSE analyses (e.g. performance indicators and harvest control rules) as well as subsequent refinements and feedback based on preliminary and ongoing results. WCPFC13 is encouraged to explore mechanisms and options for facilitating and funding these arrangements.

107. SC12 reviewed an evaluation of candidate harvest control rules for the tropical skipjack purse seine fishery (SC12-MI-WP-06). SC12 recommends that WCPFC13 note i) the utility of the approach taken for evaluating harvest control rules, ii) the associated need to develop appropriate performance indicators to adequately track effort creep in this and other fisheries in the WCPO, and iii) the need to identify an appropriate time-frame for evaluating the effectiveness of a harvest control rule.

108. SC12 was informed about the work undertaken by the Northern Committee and the ISC on the development of harvest control rules and Management Strategy Evaluation for Pacific bluefin and North Pacific albacore stocks (SC12-MI-WP-07). SC12 recommends that WCPFC13 note these developments and consider the need to facilitate discussion on Management Strategy Evaluation between those groups undertaking such work within the WCPO (i.e. the Scientific Service Provider and ISC) and across all t-RFMOs.

5.2 Limit reference points for WCPFC sharks

5.2.1 Identifying appropriate limit reference points for elasmobranchs for the WCPFC

109. Based on a request from WCPFC12, SC12 developed a scope of work to progress development of limit reference points for sharks within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). The adopted scope of work for this project is in Attachment F. WCPFC13 is requested to note the development of this project scope.

5.3 Implementation of CMM 2015-01

5.3.1 Yellowfin tuna catch limit

110. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on how to further develop catch limit options for yellowfin tuna as specified in paragraphs 28, 29 and 43 of CMM-2015-01. SC12 reiterated its advice from SC11 that yellowfin tuna stock status in the WCPO is relatively insensitive to whether purse seine effort is comprised of mainly associated sets or unassociated sets. SC12 also noted that the latest catch estimates for 2015 suggest that catch of yellowfin in the longline and purse seine fisheries appears relatively stable and as such several CCMs do not consider yellowfin catch limits in the longline and purse seine fisheries to be immediately necessary. Nevertheless, some concern was expressed with the increase in yellowfin catch reported in the “other” fisheries category, particularly in the Indonesian and Philippines handline fisheries, though it was noted that these catches are presently provisional and increases may be attributed to changes in data collection in recent years. SC12 therefore recommended WCPFC13 consider the need for continued improvements for data collection in these fisheries and the need for CCMs to provide information to the Commission on the management tools they have available to them to bring these catches under control.

5.3.2 Other issues related to CMM 2015-01

111. SC12 reviewed a management option to limit bigeye catches on purse seine vessels with higher percentage of bigeye tuna catch to assist the recovery of the bigeye tuna stock in the WCPO (SC12-MI-WP-09) though noted that further work on this option was required to clarify and validate specific outcomes. SC12 was also informed about additional options considered by some CCMs (e.g., the introduction of FAD charges to manage FAD usage in PNA waters) to achieve this same objective. SC12 recommends that WCPFC13 note that there are various options to limit bigeye catches on purse seine vessels when considering additional management measures for rebuilding the bigeye tuna stock within the WCPO.

112. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on proposals from CCMs that wish to claim exemption from the 2017 high seas FAD closure on the basis of footnote 5 of CMM 2015-01. SC12 was informed that the EU would be requesting such an exemption on the basis of the 2015 bigeye catch in the purse-seine fishery

according to SC12-MI-IP-06. However SC12 has not been able to review this proposal due to the lack of guidance on how this review should be done. SC12 also noted that the present CMM is unclear as to how this exemption is to be applied as it does not specify a time period over which the drop in bigeye bycatch to no more than the 55% level of 2010-12 average needs to be sustained. SC12 recommends that TCC12 and WCPFC13 clarify how this assessment should be done.

113. SC12 reviewed candidate indicators of effort creep in the WCPO purse seine fishery (SC12-MI-WP-08) noting that SPC had undertaken the work for the PNA to inform consideration of adjusting the Vessel Day Scheme TAE for effort creep. SC12 strongly supported this work, noting that this work was also directly relevant to the development of a harvest control rule for skipjack. SC12 also identified effort creep as an important issue related to all fleets operating in the WCPO and recommends that WCPFC13 take note of these comments and prioritise continued research on this important issue.

AGENDA ITEM 6 – ECOSYSTEM AND BYCATCH MITIGATION THEME

6.1 Ecosystem effects of fishing

6.1.1 Review of research and information

6.1.1.1 SEAPODYM

114. SC12 recommended that WCPFC13 endorse the results of the review of SEAPODYM (EB-IP-14) as follows:

SEAPODYM has the potential to be a useful complementary model to MULTIFAN-CL for MSE work that includes spatial management. Similarly, the capacity of SEAPODYM to include alternate oceanographic states (e.g. ENSO phases and climate change projections) would allow climate proofing (reducing risks and capitalizing on opportunities presented by climate change) to be a consideration in the MSE work undertaken by WCPFC.

6.2 Sharks

6.2.1 Review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks

Choice of longline mitigation approaches

115. The following conclusions of SC12-EB-WP-06 were acknowledged by SC12:
- The possibility offered in CMM 2014-05 to choose which fishing technique is excluded (either wire trace or shark-lines) has the potential to substantially lessen the reductions of fishing mortality to silky shark and oceanic whitetip shark; and
 - By choosing to exclude the technique least used by their fishing vessels, the median predicted reductions in fishing-related mortality are 6% for silky shark and 10% for oceanic whitetip shark. This compares to reductions of 24% and 37% respectively if choice was removed and both techniques excluded.

Furthermore:

- Survival rate post release is a crucial factor to evaluate the fishing mortality on shark species.
- CMM 2014-05 entered into force in July 2015 and the fleet gear characteristics data used in this analysis are prior to the adoption of this CMM and covering only a short timeframe.
- Work on the estimation of reliable post release survival rates of sharks and in particular those covered by CMM 2014-05 is prioritised under the SC Work Plan.

116. SC12 also acknowledged the following conclusions of SC12-EB-WP-03:

- Redistribution of effort from FADs to free schools resulted in substantial reductions in estimated catches of silky shark (by 83%) and oceanic whitetip shark (by 57%) compared to the ‘status quo’. There was large uncertainty in total catch estimates due to low confidence in assumed estimates of non-zero shark catches.

6.2.2 Review of conservation and management measures for sharks

a. CMM 2010-07 (CMM for Sharks)

117. With regard to CMM 2010-07 (CMM for Sharks), especially related with Paragraphs 4, 8, and 13 with reference to data provision, fin to carcass ratios, and the need for a revised or new CMM, SC12 recommended that TCC12 and WCPFC13 note that SC12 was able to review the ratio of fin weight to shark carcass weight from one study (SC11-EB-IP-03). This study demonstrated that shark fin weight data have some serious limitations, potential biases and errors. SC12 was unable to confirm the validity of using a 5% fin to carcass ratio in CMM 2010-07 and forwards these concerns to TCC, noting that an evaluation of the 5% ratio is not currently possible due to insufficient information for all but one of the major fleets implementing these ratios. SC12 took note of SC12-EB-IP-02 that confirms that the information which can be used to evaluate the effectiveness of the WCPFC ban on shark finning (CMM 2010-07) is currently very limited.

b. CMM 2014-05 (CMM for sharks)

Shark targeting and management plans

118. SC12 considered that it is problematic to agree and apply a definition of longline fisheries “targeting” sharks, noting that fisheries need not be targeting sharks to be having a significant impact on vulnerable shark stocks. The Commission may wish to refer to the potential definitions in WCPFC-2016-SC12-EB-WP-05 as a starting point for further consideration, if required.

119. SC12 recommended that the Commission adopt the contents list at Attachment G for the development of any new shark management plans.

120. SC12 recommended that the Commission review newly submitted shark management plans for completeness and quality, with a view toward encouraging continuous improvement and documenting the scientific basis for all national management measures referenced in the shark management plans.

c. Safe release guidelines

121. SC12 agreed to change the title of ‘Guidelines for the safe release of encircled animals, including whale sharks’ to ‘Guidelines for the safe release of encircled whale sharks’.

6.2.3 Shark Research Plan

- a. Progress of shark research plan

122. SC12 adopted the review of the Shark Research Plan (Attachment H).

- b. Information on non-key-shark species

123. SC12 recommended that the process for the designation of key shark species should be clarified by the WCPFC Secretariat and TCC.

124. SC12 recommended that TCC12 clarifies that the designation of a shark species as WCPFC "key shark species for assessment":

- 1. is not involving any change in the reporting requirements and logsheets of CCMs;**
- 2. meets the requirements of para 4 of CMM 2010-07;**
- 3. results in its listing under the Sharks Research Plan.**

125. SC12 recommended that purse seine observer training programmes add emphasis to Mobula spp. identification as part of their curricula.

126. SC12 recommends that WCPFC13 takes note of SC-EB-WP-08 and SC12-EB-IP-09 and considers adopting guidelines for safe release of Manta and Mobula rays caught incidentally in WCPFC fisheries.

6.3 Seabirds

127. Regarding the results of research on seabird distributions, SC12 recommended that the Commission:

- 1. Note that the northern limit of the spatial distribution of seabird density data presented extends to areas north of 30°S.**
- 2. Within the southern hemisphere part of the WCPO the main area of distribution for New Zealand's vulnerable seabirds, especially the Antipodean albatross and the black petrel, is south of 25°S.**
- 3. Note that use of effective bycatch mitigation measures across the full range of at-risk seabirds should enhance conservation of those seabirds.**
- 4. Note the above information from SC12 and other relevant information when discussing seabird mitigation measures and request that the TCC consider reviewing the 30°S boundary of the seabird CMM further north.**

Seabird bycatch mitigation measures for small-scale longline vessels

128. Regarding the results of tori line research, SC12 recommends that the Commission:

- Note the tori line options reported here (EB-WP-10 and EB-WP-13), developed especially for small longline vessels, and recognise that some of the options may have the potential to be effective in reducing seabird bycatch. SC12 recommends to continue the experimental trials of tori line designs and procedures adapted to the activities of small-scale longline vessels.**

- Consider these tori line designs, together with the information on their effectiveness in reducing seabird bycatch and usability in actual fishing operations, during the review or development of any updated tori line specifications, as will be required for the review of specifications set out in CMM 2015-03.

6.4 Sea turtles

129. SC12 recommends that the Commission notes:

The results from the first workshop on Joint Analysis of Sea Turtle Mitigation Effectiveness in Longline Fisheries. The workshop considered data from 31 fleets and factors associated with 2,300 observed sea turtle interactions. The results indicated that interactions rates are lower when large circle hooks are used, higher at the two hooks closest to the floats and higher when squid baits are used.

The recommendations for future work are noted and look forward to receiving the results from the second workshop to be held in November 2016.

6.5 Data exchange

130. SC12 noted that the Bycatch Data Exchange Protocol (BDEP) is currently designed for the purpose of dissemination of bycatch data.

131. SC12 considered the following three options for future work:

- A. Basic, no-cost (reprioritise other data management tasks). Continue trial in 2017-18 (1), publish on web (2), with any issues addressed in the generic data gaps paper.
- B. Enhance, low cost. As for A., plus, resolve purse seine form links (3), provide table of observer effort (4), resolve vessel identifiers (5), report seabirds to the species level (6), include marine mammals (7).
- C. Focus, moderate cost. As for B., plus, review and update L:L and L:W relationships for SSIs (Species of Special Interest) (8), and undertake regional trial (9).

132. SC12 recommended that the Commission notes that SC12 recommends the choice of Option A (Basic, no cost).

AGENDA ITEM 7 – OTHER RESEARCH PROJECTS

7.1 West Pacific East Asia Project

133. SC12 was briefed on the progress of the WPEA project, a GEF-funded 3-year project working together with Indonesia, Philippines and Vietnam and managed by the Secretariat.

7.2 Pacific Tuna Tagging Project

134. The 9th Steering Committee meeting for the Pacific Tuna Tagging Project was held during SC12, and the PTTTP Steering Committee made the following recommendations to SC12:

- a) that the tagging programme be normalised as part of the ongoing work of SC, ideally with cruises every year alternating between skipjack-targeted via pole and line fishing in one year and bigeye-

targeted via handline and dangler fishing in the next and starting with skipjack in 2017 (yellowfin would also be covered by these surveys); and

- b) that SC supports efforts to identify sustainable financing of the tagging programme, through a combination of WCPFC budget support and voluntary contributions from WCPFC members or other stakeholders.

135. SC12 endorsed the two recommendations of the PTTP Steering Committee above.

7.3 ABNJ (Common Oceans) Tuna Project-Shark and Bycatch Components

136. A brief overview of the ABNJ (Common Oceans) Tuna Project activities being led by the WCPFC Secretariat and SPC was presented, covering shark data improvement and harmonization, shark stock status assessment, and bycatch management and information.

137. Noting that information about a Hawaii and American Samoa tagging project had been presented earlier in the meeting, USA noted its willingness to collaborate in post-release mortality tagging projects in the Pacific, urging consistency in project design.

7.4 WCPFC Tissue Bank (Project 35b)

138. SPC-OFP provided a report on the work of Project 35, which consists of research on the age and growth and reproductive biology of bigeye tuna and the operation of the WCPFC Tissue Bank.

139. SC12 adopted the revised WCPFC Tissue Bank Project protocols (Attachment I).

AGENDA ITEM 8 – COOPERATION WITH OTHER ORGANISATIONS

140. SC12 reviewed the status of cooperation with other organizations.

AGENDA ITEM 9 – SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

141. SC12 discussed intersessional activities related to science capacity building, including for developing States and participating territories supported by the Commission's Special Requirements Fund and the Japan Trust Fund (JTF).

AGENDA ITEM 10 – FUTURE WORK PROGRAM AND BUDGET

10.1 Development of the 2017 Work Programme and budget, and projection of 2018-2019 provisional Work Programme and indicative budget

142. The SC 2017 Work Programme and budget and provisional work programme and indicative budget for 2018-2019 were adopted (Attachment J).

Table 1: List of SC work programme titles and budget for 2017, and indicative budget for 2018–2019, which require funding from the Commission’s core budget. Other projects also prioritised by SC12 without funding request are also listed to indicate the support by SC12 for those projects.

(Budget in USD)

Project title	TORs	Essential	Priority / Rank	2017	2018	2019
SPC Oceanic Fisheries Programme Budget		Yes		871,200	871,200	871,200
SPC – Additional resourcing for harvest strategy evaluation, including stock assessments		Yes		160,000	160,000	160,000
Project 14. West Pacific East Asia (WPEA) Project		Yes		25,000	25,000	25,000
Project 35b. Maintenance and enhancement of the WCPFC Tissue Bank	Annexed	Yes	High	95,000	95,000	95,000
Project 42 Pacific Tuna Tagging Programme (PTTP) <i>Additional funding required from external sources</i>	Annexed	Yes	High	250,000 950,000	500,000 190,000	650,000 550,000
Project 60: Further paired sampling and unloading data comparisons.	Annexed		Medium / 1	50,000	0	0
Project 67: Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area	Annexed		Medium / 4	40,000	40,000	30,000
Project 68. Estimation of seabird mortality across the WCPO Convention area	Annexed		Medium / 3	72,500	22,500	17,500
Project 78 Review of shark data and modelling framework to support stock assessments	Annexed		Medium / 2	65,000	0	0
Project 79 Spatial longline analyses in support of bigeye tuna management in the WCPFC	Annexed		NR ¹	NBR ²	0	0
Unobligated (Contingency) Budget <i>Note:</i> Any science-related projects requested by the Commission with no budget allocation				83,000	83,000	83,000
SC12 TOTAL BUDGET	Excluding External Funding of Project 42			1,711,700	1,796,700	1,931,700
	Including External Funding for Project 42			2,661,700	1,986,700	2,481,700

1. NR = Not Ranked, 2. NBR = No Budget Request from WCPFC

AGENDA ITEM 11 – ADMINISTRATIVE MATTERS

11.1 Process for the independent review of stock assessments

143. SC12 endorsed a process for the independent review of stock assessments (Attachment K).

11.2 Future operation of the Scientific Committee

144. SC12 provided a number of suggestions for better operation of the future Scientific Committee, which will be reflected in future meetings.

11.3 Election of Officers of the Scientific Committee

145. The SC Chair B. Muller was approved as SC Chair for the next 2 years, and the SC Vice-Chair, A. Batibasaga, reconfirmed his availability to complete his two year term.

11.4 Next meeting

146. SC12 confirmed that SC13 in 2017 would be held in the Cook Islands and proposed that SC14 in 2018 be held in Korea.

AGENDA ITEM 12 – OTHER MATTERS

147. Indonesia made a statement urging SC to develop tools to estimate the catch from IUU fishing and related activities, and conduct analysis to deliver appropriate advice on IUU fishing to managers.

AGENDA ITEM 13 – ADOPTION OF THE SUMMARY REPORT OF THE TWELFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

148. SC12 adopted the recommendations of the Twelfth Regular Session of the Scientific Committee, noting that they had been worked on extensively during the theme sessions. According to the Rule 33 of the Commission’s Rules of Procedure, the following procedure for the development of SC12 Summary Report was agreed on by the SC12 plenary.

Due by	Activity
11 August	Close of SC12
18 August	Theme convenors receive SC12 draft summary report for review from the Secretariat
23 August	The Secretariat receives theme convenors’ comments
23 August	The Secretariat posts the provisional Executive Summary on the SC12 website
26 August	The Secretariat distributes the draft summary report to all CCMs and Observers by email
30 September	The Secretariat receives comments from CCMs and Observers

AGENDA ITEM 14 – CLOSE OF MEETING

149. The meeting closed at 3:20pm on Thursday 11 August 2016.

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

**Scientific Committee
Twelfth Regular Session**

Bali, Indonesia
3-11 August 2016

SUMMARY REPORT

AGENDA ITEM 1 – OPENING OF THE MEETING

1. The Twelfth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean took place from 3-11 August 2016 at the Stones Hotel in Bali, Indonesia.
2. The following CCMs attended SC12: The following Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC) CCMs attended SC12: American Samoa, Australia, China, Cook Islands, European Union (EU), Federated States of Micronesia (FSM), Fiji, Indonesia, Japan, Kiribati, Republic of Korea, Marshall Islands, Nauru, New Caledonia, New Zealand, Papua New Guinea (PNG), Philippines, Samoa, Solomon Islands, Chinese Taipei, Tokelau, Tonga, Tuvalu, United States of America (USA), Vanuatu, Vietnam and Wallis and Futuna.
3. Observers from the following inter-governmental organizations attended SC12: Agreement on the Conservation of Albatrosses and Petrels (ACAP), Pacific Islands Forum Fisheries Agency (FFA), Inter-American Tropical Tuna Commission (IATTC), Parties to the Nauru Agreement (PNA), Secretariat of the Pacific Community (SPC) and the Food and Agriculture Organization of the United Nations (FAO).
4. Observers from the following non-governmental organizations attended SC12: Birdlife International, Conservation International, Earth Island Institute, Environmental Defence Fund, Greenpeace, International Seafood Sustainability Foundation, Korea Institute of Ocean Science and Technology, Marine Stewardship Council, The Nature Conservancy, The Pew Charitable Trusts, Sustainable Fisheries Partnership, and WWF.
5. The full list of participants can be found at **Attachment A**.

1.1 Welcome address

6. The Commission Chair, Ms Rhea Moss-Christian made some opening remarks. She thanked the SC Chair for stepping in as Chair and acknowledged the outgoing SC Chair, Ludwig Kumoru (PNG), for his efforts over the last three years. The Commission Chair laid out her three key priorities for the Commission this year and SC's contribution to that: making progress on the harvest strategy for key species, beginning discussions on the draft bridging tropical tuna CMM with a view to adoption for the post-2017 period, and making progress on strengthening shark conservation and management. She acknowledged that the Commission will continue to have other important priorities, such as improving fisheries observer safety, strengthening the transshipment measure and continuing to improve on the

Commission's compliance monitoring scheme. On the harvest strategy, the Commission Chair expected that with SC12's input, the Commission should be able to make progress on key harvest strategy elements for skipjack and south Pacific albacore, the bigeye tuna rebuilding timeline and acceptable levels of risk for all four key species. The Commission Chair noted that she had circulated draft harvest strategy management objectives in July and would be looking to the Commission to record these in December. The Commission Chair noted that the Consultative Draft containing the draft bridging CMM on tropical tunas was a joint effort between the Executive Director and the Chair. The stock assessments that SC12 would be considering during this meeting would be critical for the discussion on the draft bridging CMM and would help lay the groundwork for a successful measure post-2017. The Commission Chair noted that progress on identifying information gaps on sharks and developing clear recommendations on how to strengthen the measures in place was an important piece of work for SC12. There was good information available for this meeting so a strong recommendation on sharks should come out of this meeting. The Commission Chair noted her availability during SC12 to discuss these issues on the margins of the meeting with interested CCMs.

7. The SC Chair, Berry Muller (RMI), expressed appreciation to the Government of Indonesia for their hospitality and thanked Commission members for their support for her as SC Chair. Muller had been selected intersessionally, and SC12 would elect a Chair for a new term at this meeting. The SC Chair thanked L. Kumoru for his past three years as SC Chair and wished him well in his role with PNA. The SC Chair noted that there were many issues to deliberate on during SC12, including stock assessments, the science aspects of harvest strategies, and ecosystem impacts. The theme convenors would be assisting the Chair to achieve tangible outcomes in these and other areas. The Chair thanked SPC-OFP, which had prepared more than 40 papers and reports for the meeting, and IATTC, IOTC and other organisations for their contributions. After thanking the Secretariat for its hard work in preparing for the meeting, and the rapporteur, Jane Broweleit, the Chair charged SC12 with providing meaningful recommendations on scientific matters to the Commission.

8. WCPFC Executive Director Feleti Teo's opening remarks noted of some major science-related developments this year: significant improvements in data collection, especially from the East Asian Seas through WPEA Project; the submission of operational catch and effort data from distant water fishing nations; progress on electronic reporting and electronic monitoring; and completed four stock assessments for SC12 to review – skipjack tuna, south Pacific blue shark, Pacific bluefin tuna and Pacific blue marlin. The full remarks from the Executive Director can be found at **Attachment B**.

9. Muhammad Zulficar Mochtar, Chairman of the Agency of Marine and Fisheries Research and Development expressed his appreciation to the SC Chair, the Commission Executive Director and WCPFC Science Manager and welcomed all participants to SC12. Mochtar observed that IUU fishing and overexploitation today are major concerns for the future of Indonesia's fisheries. Any neglect of IUU in scientific advice could lead to fisheries management failure threatening the fish resources and the livelihoods of millions of peoples who rely on fishing. The full remarks from the Chairman of the Agency of Marine and Fisheries Research and Development can be found at **Attachment C**.

10. The SC Chair asked delegates to keep the Chairman of the Agency of Marine and Fisheries Research and Development's remarks in mind throughout the meeting.

11. Some CCMs noted great progress on gender issues, notably the Indonesian Minister of Maritime Affairs and Fisheries, Susi Pudjiastuti, and WCPFC's three women in Chairperson roles – the Commission Chair, Rhea Moss-Christian, the TCC Chair, Alexa Cole, and the SC Chair, Berry Muller – and the WCPFC Compliance Manager, Lara Manarangi-Trott.

12. The meeting opened at 9:50am on Wednesday 3 August 2016.

1.2 Meeting arrangements

13. The SC Chair ran through meeting arrangements including session and break times, side events and the 11 informal small working groups (ISGs), some of which would be starting their work shortly. It was noted that the SC Vice Chair was Aisake Batibasaga and theme convenors for SC12 were introduced: B. Muller supported by P. Williams (Data and Statistics theme), J. Brodziak and H. H. Nishida (Stock Assessment theme), R. Campbell (Management Issues theme), A. Batibasaga and J. Annala (Ecosystems and Bycatch Mitigation theme).

ISG-1	Development of SC Budget for 2017 – 2019	B. Muller
ISG-2	Project 57 – Scope of work for shark limit reference points	R. Campbell
ISG-3	A formal process for the independent review of stock assessment	K. Bigelow
ISG-4	Definition of public domain data and amendment of the <i>Scientific Data to be provided to the Commission</i>	L. Olsen
ISG-5	Designation of key shark species	S. Varsamos
ISG-6	Review of Shark Research Plan and future work plan	J. Larcombe
ISG-7	<i>Ecosystem indicators and budget</i>	<i>Withdrawn</i>
ISG-8	Development of <i>New guidelines for the survival of sharks (other than whale sharks) to be released from longline or purse-seine gear</i>	H. Kiyofuji
ISG-9	Review of Tissue Bank Protocol	N. Smith
ISG-10	Finalize Bycatch Data Exchange Protocol (BDEP) template	N. Smith
ISG-11	Guidelines for development and evaluation of shark management plan	S. Clarke
ISG-12	Future arrangements for the support of management strategy evaluation	R. Campbell

14. Indonesia informed delegates that it had hosted the Commission meeting in Bali in 2015 and now hosted the SC. It was noted that there was around 200 participants. Indonesia advised of two events it would host for delegates through the meeting.

15. The WCPFC Executive Director introduced the Secretariat support staff facilitating the meeting.

1.3 Issues arising from the Commission

16. The WCPFC Science Manager drew SC12's attention to SC12-GN-WP-03, which contained an extract of some of the recommendations made in the previous year and instructions to SC from the Commission.

1.4 Adoption of agenda

17. The SC Chair noted that the last revision of the agenda was posted on 27 July 2016. Delegations were advised that any issues which would be raised under agenda item 12 could be raised under this agenda item. No delegations raised issues at this time.

18. The SC12 provisional agenda WCPFC-SC12-2016-02_rev4 was adopted (**Attachment D**).

1.5 Reporting arrangements

19. The SC Chair outlined the reporting arrangements for the meeting, noting that theme convenors would take the lead in preparing the draft theme reports, with the rapporteur providing notes on the

discussions within plenary to assist them to do so. The theme convenors and the rapporteur would work together to clear the recommendations. The SC Chair asked the theme convenors to provide a summary for the group of their idea of what the recommendations would include during the theme sessions, and delegates were asked to ensure they raise the issues they wanted considered during the discussion sessions so the theme convenors could be mindful of their comments.

1.6 Intersessional activities of the Scientific Committee

20. The WCPFC Science Manager provided a brief introduction to SC12-GN-WP-04, which outlined what the WCPFC Secretariat had done during the intersessional period. The paper summarised the work of the scientific services provider, SPC, including what was provided for SC12, as well as progress and status on projects being undertaken including the ABNJ project, Japan Trust Fund (JTF) and WPEA project. The paper also outlined international cooperation and collaboration with other organisations.

21. In response to a question regarding data or expert advice provided to the CITES Secretariat for shark listing proposals in the lead-up to CITES COP17, S. Clarke (Secretariat) noted that the CITES Secretariat had contacted WCPFC in May 2016 asking for information. WCPFC had responded in a letter in July which directed the CITES Secretariat to the areas on the WCPFC website which contained information relating to the silky shark, thresher shark and mobulid CITES proposals. The CITES Secretariat had confirmed that they had received this letter. Clarke noted that this work was ongoing and updates would be made available.

AGENDA ITEM 2 – REVIEW OF FISHERIES

2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries

22. P. Williams and C. Reid (SPC) presented SC12-GN-WP-01, a broad overview of the fisheries including economic conditions.

23. The provisional total WCP-CA tuna catch for 2015 was estimated at 2,687,840 mt, the third highest on record and nearly 200,000 mt below the previous record catch in 2014 (2,882,511 mt); this catch represented 80% of the total Pacific Ocean catch of 3,379,789 mt, and 56% of the global tuna catch (the provisional estimate for 2015 is 4,799,697 mt, and when finalised is expected to be the second highest on record).

24. The 2015 WCP-CA catch of skipjack (1,827,750 mt – 68% of the total catch) was the third highest recorded, nearly 180,000 mt less than the record in 2014 (2,005,647 mt). The WCP-CA yellowfin catch for 2015 (605,963 mt – 23%) was the second highest recorded (less than 1,000 mt lower than the record catch of 2008 – 606,868 mt); the increase in yellowfin tuna catch from 2014 levels was mainly due to increased catches in the Indonesia and Philippines domestic fisheries. The WCP-CA bigeye catch for 2015 (134,084 mt – 5%) was the lowest since 1996 due to relatively low catches in the longline and purse seine fisheries. The 2015 WCP-CA albacore catch (120,043 mt - 4%) was the lowest since 2011 and nearly 28,000 mt lower than the record catch in 2002 at 147,793 mt. The WCP-CA albacore catch includes catches of north and south Pacific albacore in the WCP-CA, which comprised 81% of the total Pacific Ocean albacore catch of 149,289 mt in 2015. The south Pacific albacore catch in 2015 (68,594 mt) was about 12,000 mt lower than in 2014 and nearly 20,000 mt lower than the record catch in 2010 of 87,292 mt.

25. The provisional 2015 purse-seine catch of 1,766,070 mt was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear.

26. The 2015 pole-and-line catch (228,129 mt) was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s. Japanese distant-water and offshore fleets (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP-CA pole-and-line catch (99% in 2015).

27. The provisional WCP-CA longline catch (243,547 mt) for 2015 was lower than the average for the past five years. The WCP-CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for three years, 21,000 mt. lower than the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery. The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past ten years.

28. The 2015 South Pacific troll albacore catch (2,576 mt) was around the average over the past decade. The New Zealand troll fleet (131 vessels catching 2,425 mt in 2015) and the United States troll fleet (6 vessels catching 151 mt in 2015) accounted for all of the 2015 albacore troll catch.

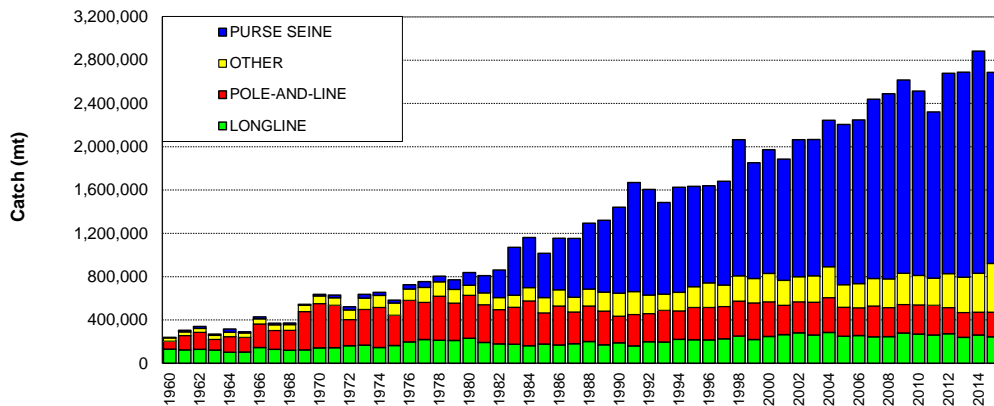


Figure 1. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA, by longline, pole-and-line, purse seine and other gear types

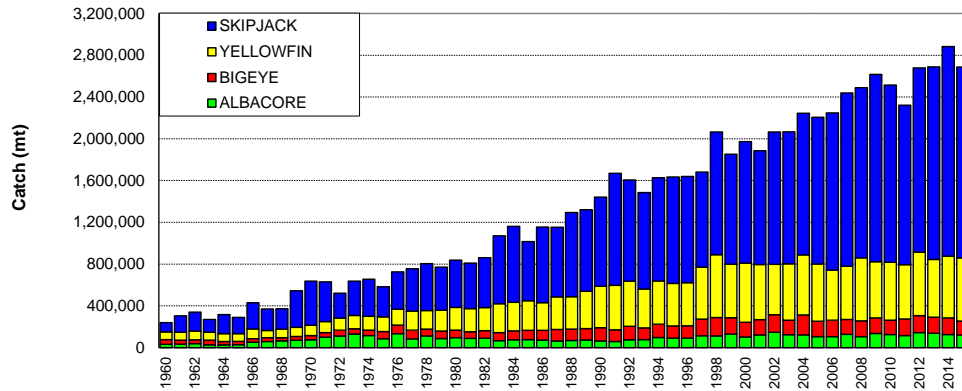
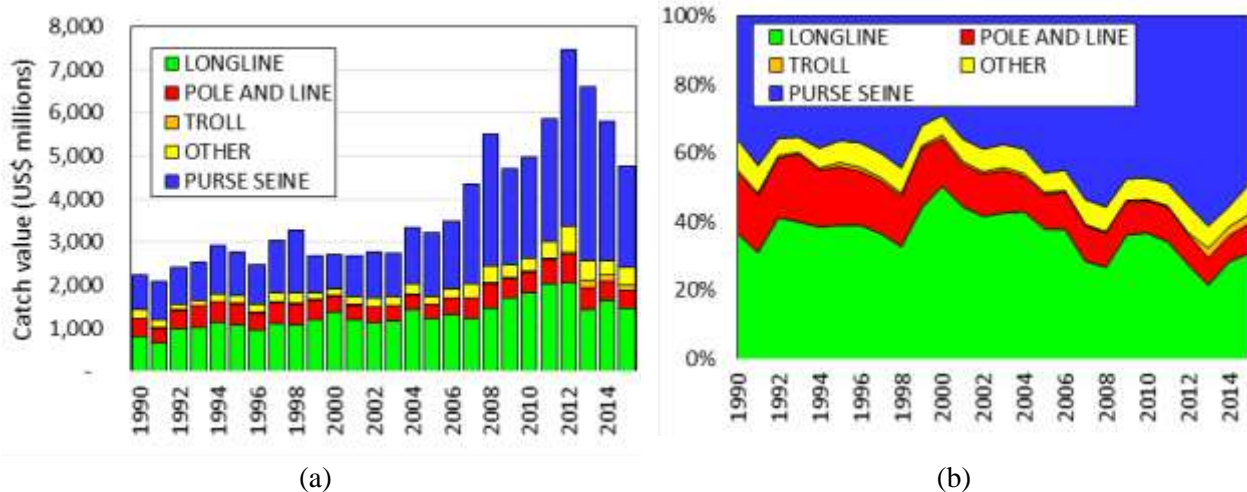


Figure 2. Catch (mt) of albacore, bigeye, skipjack and yellowfin in the WCP-CA



Figures 3a and 3b: Catch value by gear type and Relative value share of gear type in the estimated delivered values of WCP-CA catch, 1990–2015.

29. Market conditions for the tuna raw materials of the WCP-CA during 2015 saw further deteriorations in the price of for canning lightmeat raw material and sashimi grade products on most markets but improvements in the price for albacore for canning.

30. Prices in the major markets for WCP-CA skipjack and yellowfin for canning were lower in 2015 compared with 2014, underpinned by an oversupply of raw material, lower demand at end markets and a general decline in global food commodity prices. For example, Thai import prices (c&f, cost and freight) for skipjack and yellowfin were 17% and 14% lower respectively. Albacore prices rose during 2015 across markets following significant increases in 2014 with, for example, prices for Thai frozen imports (c&f) rose 5%, Japan selected ports fresh (ex-vessel) prices in USD rose 6% and US fresh import prices (f.a.s. or FAS, Free Alongside Ship) were up 7%.

31. USD prices on the main markets for longline caught sashimi products (yellowfin and bigeye) in Japan declined in 2015. The 2015 average price for the Japan fresh yellowfin imports was down 13% while Yaizu longline caught yellowfin fresh/frozen price decreased by 18%. US fresh yellowfin import price in 2015 were marginally lower (2%) than for 2014. The Japanese fresh bigeye import price fell 8%

while the Japan selected ports frozen price decline by 14%. The US fresh bigeye import price in 2015 increased 4%.

32. The total estimated delivered value of catch in the WCP-CA declined by 18% to \$4.8 billion during 2015. This is the third consecutive year of a decline in catch values since the peak of \$7.5 billion in 2012. The value of the purse seine fishery declined by 28% from the previous year to \$2.3 billion with its contribution to the total catch value falling to 49% (56% in 2014). The value of the longline fishery also declined, down 11%, to \$1.5 billion but its contribution to the total catch value increased to 31%. In terms of value by species, all species declined in value except albacore which remained steady at \$357 million result in its contribution to the total catch value rising to 7%. The value of the bigeye catch declined by 20% to \$605 million (13% of the total catch value). The value of the skipjack catch declined the most, falling by 24% to \$2.3 billion or 49% of the total catch value. The yellowfin catch value declined by 11% to \$1.5 billion (32%).

33. Economic conditions in the purse seine, tropical longline and southern longline fisheries of the WCP-CA – improved, albeit marginally in some cases, in 2015 compared with 2014. The purse seine fishery saw increases in catch rates and declines in costs which more than offset declines in prices. In the tropical longline fishery conditions improved only marginally compared with 2014 despite a significant fall in fuel prices as the effect of the resulting decline in costs was largely offset by declines in the catch rate and fish prices. For the southern longline fishery economic conditions improved significantly in 2015 primarily driven by falling fuel costs with the fish price remaining around its 2014 level. However, persistent low catch rates continue to impact on economic conditions in the southern longline fishery and if they continue the likelihood of economic conditions returning to higher historical average levels remains low.

34. It was noted that SC12-ST-IP-01 contained tables of annual catch estimates in the WCPFC Convention Area.

35. Japan queried the purse-seine CPUE levels and the conclusion by SPC that the reduction in purse-seine catch in 2015 was due to a reduction in effort, noting that 2015 effort was much less than the recent average, but when comparing 2014, when record catch was observed, 2015 effort the reduction was not as significant. Japan suggested catchability might be decreased. In addition, Japan requested that SPC provide not only the ratio of the purse-seine sets by country, but also the exact number of sets by some major fleets.

36. SPC advised that it could consider Japan's request for including the actual number of sets by set type for major fleets as a suggestion for future versions of the paper, noting that this information is also in data summaries are prepared for both TCC and Commission meetings. It was recognised that while the main factor in the reduction of catch was the reduction in effort, it might not be the sole reason. SPC clarified that there were record CPUE levels for certain fleets, but this was not the case overall for all fleets in the fishery.

37. Noting that the 2015 yellowfin catch was close to the highest recorded, and that most of the increase from 2014 was accounted for by Philippines and Indonesia's domestic fisheries, FFA members requested that these CCMs provide more information on the increase. FFA members noted decreased catches for skipjack, bigeye and south Pacific albacore tuna and the upwards trend of longline effort estimates for the eastern area of the tropical WCPFC longline fishery. These CCMs wondered whether the trends of lower efforts in the tropical convention area were accurate and if so whether it was a result of management measures, adverse economic conditions or a combination of factors. These CCMs noted the drop in value of the purse-seine fishery driving the decrease in the total value of tuna catch in the Convention area.

38. Indonesia observed that, typically, when supply drops the price increases but in this case both the supply and price had dropped. Noting that yellowfin tuna is distributed to the western area and albacore tuna is within the central area, Indonesia queried whether this reflected the natural distribution of the fish or whether it reflects fishing behaviour. Indonesia asked for further information about fleet tie-up.

39. FFA advised that the bigeye tuna price in recent years has increased in Japanese Yen terms, but because of the appreciation of the US dollar (USD) it has declined in USD terms. Prices are converted to USD to enable consistent comparisons. Regarding fleet tie-ups, FFA explained that due to a reorganisation of US Tuna Treaty arrangements, the US fleet did not fish in the early months of 2016 and did not supply the market. Regarding the dominance of yellowfin tuna in the longline catch in the western tropical areas, SPC noted that differences in targeting can account for this but also noted that fundamental differences in environmental conditions (e.g. a shallower thermocline in the east) was more conducive to higher levels of bigeye tuna catch in the east compared to western areas where yellowfin tuna dominates the catch. SPC added that albacore tuna is understood to be primarily a temperate species, caught further away from the equator.

40. PNA members supported concerns expressed by FFA. Noting their experience with the Vessel Day Scheme (VDS), PNA considered the clear drop in purse-seine effort and catches were due to oceanographic and economic factors. These CCMs observed that the data indicated high seas purse-seine effort doubled in 2015, and there were increases in longline effort in the core tropical longline fisheries areas despite an agreement to cut longline bigeye catches by 30%. These CCMs were encouraged that the tropical tuna CMM was having an effect, but considered that key elements still needed to be tightened. For PNA members, the lack of monitoring, verification and control on high seas longline operations remained a challenge.

41. Japan queried why tonne per day was chosen as the measurement for CPUE analysis, suggesting tonnes per set as an alternative.

42. SPC advised that both could be used, but SPC attempted to provide standardised effort data and advised that this could be included in the paper in the future if SC would find that beneficial.

43. PNA members thanked SPC for providing the data on vessel numbers in the tropical purse-seine fishery which these CCMs had requested at SC11. These data showed a significantly lower number of vessels in the purse-seine fleet in 2015 and significantly lower growth in that fleet in recent years. These CCMs suggested further work on rationalising the purse-seine fleet size data for next year.

44. EU asked whether the CPUE trends are consistent when associated and non-associated sets are considered separately and asked about the economic trends including profitability of the different fisheries. EU requested a more detailed breakdown of the purse seine fleet, species, and whether the fleet was using FADs or not, noting that sometimes they do both, to better appreciate the various economic conditions.

45. SPC drew delegates' attention to the breakdown by set types in Figure 20, noting that this was a nominal CPUE and did not take into account other factors; this issue could benefit from a dedicated study. Regarding profitability, FFA noted that the index gives a measure of relative economic conditions and general trends, not absolute profitability. The index gives a general view of the tropical longline and southern longline fleet, but FFA could look at breaking this down into the different components of the fleet.

46. EU noted that Figure 20 showed that the increase in CPUE is driven by data from one fleet and wondered why this particular fleet had such different CPUE trends compared with the others.

47. SPC noted that the record skipjack CPUE levels for this fleet (Korea) and that they tend to fish more on unassociated sets but it would require further investigation since this trend was not apparent with the other fleets.

48. Korea noted that they had submitted 2014 and 2015 operational level data so that SPC could do analysis for that.

49. Australia noted that Figure 20, especially in regard to drifting FADs, showed a substantial difference between the fleets, with Korea the highest and Japan having decreased, and that USA fished as they had in 2014 and their CPUE levels had not go up. Korea fished in the far eastern tropical WCPFC area (Figure 14), which is where it is understood the fishery had extended to under El Nino conditions and Australia noted there was a correlation between where the fish was distributed and the changes in CPUE and movements of the fleets. Regarding the comparison with FAO Food Index and Bangkok prices, Australia noted that WCPFC economic reports had essentially locked in the \$7bn figure but \$4-5bn might be a more realistic long-term average.

50. Indonesia suggested including estimations of catch from IUU fishing in the overview of fisheries.

51. PNG noted a 2016 MRAG/FFA report quantified IUU in the fisheries occurring in FFA waters.

52. Australia noted that that report cited some quite high numbers and asked whether SPC had any comments about its accuracy, including how high the unaccounted catch might be.

53. SPC stated that a lot of the figure would be related to misreporting (for example counting juvenile yellowfin tuna inaccurately as skipjack tuna) and the numbers of unknown or unlicensed vessels (i.e. illegal fishing) would be very small. Where there is a high level of understanding about a particular issue, such as yellowfin tuna being recorded as skipjack tuna, SPC tries to account for it by using observer data.

54. FFA members stated that the number of vessels in the longline fishery shown in Figure 35 bears little relation to the actual effort and catch in the fishery, shown in Figure 36, over the past 15 years and there was a need to move as quickly as possible away from vessel number capacity management measures such as the albacore and billfish CMMs to controls using a harvest strategy approach.

55. In response to a question from China about the CPUE nominal distribution and a comparison of the tropical and temperate purse-seine fishery, SPC noted that they could consider adding it into one of the working papers for SC next year.

2.2 Overview of Eastern Pacific Ocean (EPO) fisheries

56. Kurt M. Schaefer, head of IATTC's Biology and Ecosystem Program, presented SC12-GN-WP-02, on current fisheries for, and assessments of, the major stocks of tunas exploited in the eastern Pacific Ocean. The fishing capacity of the purse-seine fleet fishing in the eastern Pacific Ocean (EPO) increased rapidly from 1995 to 2005, and was fairly stable during 2006-2014, but increased 17% in 2015 to 248,000 cubic meters of well volume. The reported nominal annual longline effort has fluctuated between about 300 and 100 million hooks over the past thirty years. The peak of about 300 million hooks in 2002-2003 was followed by a distinct decline to about 100 million hooks, but in recent years this has increased to about 200 million hooks. Total tuna catches increased starting in 1999, peaked in 2003, and in 2015 were slightly above the average of the previous ten years.

57. For yellowfin tuna, catches were fairly stable from 1986-1999 followed by a peak during 2001-2003, a substantial decline during 2006- 2008, and then a steady upward trend. The 2015 catch from

dolphin- associated schools was similar to the previous two years, whereas for unassociated schools the catch was about double the average of the previous four years. The current stock assessment method used for yellowfin is Stock Synthesis 3. A major change in the stock assessments of yellowfin and bigeye tunas in 2016 is the treatment of the longline length-composition data, to account for variation in the methods used to measure the size of the individual fish. Since 2008 recruitment has been relatively low, though not quite as low as it was during 1979-1981. Recent estimates indicate that the yellowfin spawning biomass in the EPO is overexploited ($S < S_{MSY}$), but that overfishing is not taking place ($F < F_{MSY}$); however, the estimates of the current status of the stock are considerably more pessimistic if a stock-recruitment relationship is assumed, if a higher value is assumed for the average size of the older fish, or if lower rates of natural mortality are assumed for adults.

58. The status of the skipjack stock has been evaluated using eight different data- and model-based indicators. The purse-seine catch has been increasing significantly since 1994, and in 2015 was the highest ever recorded, and substantially above the upper reference level. Following a large peak in 1999, the catch per day fished on floating objects has generally fluctuated between an average level and the upper reference level. The value for 2015 was similar to that of 2014, and below the upper reference level. The catch per day fished on unassociated schools has fluctuated at high levels since 2005, and in 2015 was at the highest level since 1975, when the time series used for the indicators began. The average weight has been steadily decreasing over the past decade, and in 2015 was the lowest in the past four decades, and below the lower reference level. The relative biomass and recruitment have been fairly high since 2002, whereas the exploitation rate has remained close to average during this same period. There is uncertainty about the status of skipjack tuna in the EPO, and there may be differences in the status of the stock among regions. However, there is no evidence that indicates a credible risk to overexploitation of the skipjack stock(s).

59. There have been substantial historical changes in the bigeye fishery in the EPO. Beginning in 1994, purse-seine catches increased substantially, due to the expanded use of drifting FADs in the equatorial EPO. The estimated total purse-seine catch of bigeye of 63,000 metric tons (t) in 2015 is similar to the average of the past decade. The estimated longline catch of bigeye of 38,000 (t) in 2015 is comparable to that of the previous five years. The current stock assessment method used for bigeye is Stock Synthesis 3. Recruitment estimates have been variable since 1975, but over the past five years have been close to average. Recent estimates indicate that the spawning biomass of bigeye in the EPO is overexploited ($S < S_{MSY}$), but that overfishing is not taking place ($F < F_{MSY}$). As for yellowfin, the estimates of the current status of the stock is considerably more pessimistic if a stock-recruitment relationship is assumed, if a higher value is assumed for the average size of the older fish, or if lower rates of natural mortality are assumed for adults.

60. In 2013, the IATTC adopted Resolution C-13-01 on the conservation of tropical tunas for 2014-2016. It includes an annual EPO-wide 62-day closure for purse-seine vessels of carrying capacity greater than 182 t, along with a 30-day closure of a core offshore FAD fishing area. For longline vessels greater than 24 m length overall, the resolution includes fixed specific bigeye catch limits for China, Japan, Korea, and Chinese Taipei, with other Members limited to the greater of 500 t or their respective catches in 2001. The IATTC staff recommends that the annual closures of the purse-seine fishery for tropical tunas established in Resolution C-13-01 be increased from 62 days to 87 days during 2017-2019, to offset the increase in purse-seine capacity, and that all the other provisions of the resolution be maintained as they are.

61. In 2014, the IATTC adopted Resolution C-14-06 on the conservation of bluefin tuna during 2015-2016. It includes a limit of 6,600 metric tons of total commercial catches during 2015 and 2016, with an additional 600 metric tons allotted to US vessels for 2015 and 2016 combined. The IATTC recommends extending the measures established in this resolution for two more years, and encourages the WCPFC to

adopt additional measures to reduce the catch of adults in order to reduce the immediate risk of a low spawning biomass affecting recruitment.

62. During the discussions which followed the presentation, USA noted that the increase in capacity eclipsed the 2005 recommendation and queried if IATTC scientific staff had provided recommendations on what a contemporary total well volume might be.

63. Schaefer noted that increased fleet capacity in the EPO had occurred due to the 2005 agreements relating to EPO coastal states' rights to bring capacity into the EPO; USA vessels moved from the western Pacific as well as purse-seine boats under the flags of Peru and Costa Rica. Those agreements made reducing the fleet capacity in the EPO difficult, noting that IATTC had sought to cap potential total capacity to 158,000.

64. In response to a question from Indonesia about discards in the EPO, Schaefer noted that discards data comes from estimates from onboard observers. Most of the discards occur at the end of trips, when boats only need a small amount of catch to fill their holds but the last set contains a lot more fish than required to fill the hold. Schaefer confirmed that discards are not necessarily small fish, although that was once the case historically. Because of higher prices, small fish are not being discarded as they once were.

65. Australia noted that there has been a strong El Niño in the WCPO in 2015, with a warm pool moving east and the fish moving with it. This CCM wondered how El Niño has influenced the EPO, and whether they were seeing anomalous changes in the oceanography.

66. Schaefer responded that the EPO-area El Niño in 2015 (and a portion of 2014) was quite substantial and there were changes in oceanography, with elevated SSTs and a deepening of the mixed layer, but it did not appear to have a strong effect regarding the distribution of the catches in the FAD fishery. Because of the move to FAD fishing, El Niños did not have the same impact as it would have in the past, noting that catches of yellowfin tuna are low in unassociated sets. The only noticeable anomaly was skipjack tuna in large schools between 130°W and 140°W, but it was unknown whether they were related to changes in oceanography or forage abundance; tag recoveries were likely to be inadequate to answer the question.

67. FFA members expressed concern that catch and effort was increasing substantially in the purse-seine fishery, with 2015 sets at record highs (33,000+ sets). These CCMs sought an explanation from the IATTC Secretariat about how this was accounted for by the IATTC capacity management scheme. Noting the outcomes of the 2015 eastern Pacific Ocean yellowfin and bigeye tuna stock assessments, these CCMs suggested that both stocks were close to the IATTC interim TRPs and noted that the reference points adopted by IATTC were lower than WCPFC, and any difference in conclusions about stock status for EPO bigeye by IATTC could diminish the urgency for management action. These CCMs also sought clarification on the changing dynamic in the EPO longline fishery, noting the increase in effort from China in the EPO.

68. Schaefer advised that this issue was raised at the IATTC annual meeting in June 2016, and noted that China's catches of bigeye tuna in the EPO in the last couple of years was second to Japan's now. China had significantly increased longline fishing effort for bigeye tuna in particular. Some IATTC members took the view that the catch limits were not intended to be transferable; that if a country was not going to utilise its catch, it was not meant to be transferred to another country. Schaefer noted his understanding that they were not meant to be transferable quotas, but limits for certain countries.

2.3 Annual Report – Part 1 from Members, Cooperating Non-Members, and Participating Territories

69. The SC Chair noted that members' Annual Reports Part 1 had been posted on the Commission website in early July 2016 and invited those members who wished to do so to provide updates on their fisheries.

70. Philippines estimated a provisional catch of 215,000 mt in 2015, which was currently being validated. Noting the concerns regarding the catches of yellowfin from Philippines and Indonesia, Philippines advised that, for the Philippines, this could be attributed to increased data collection initiatives including e-reporting and e-monitoring in High Seas Pocket 1, expansion of the national stock assessment program, and a port sampling program that now covers almost all of the tuna landing ports in the country. Philippines has strengthened its observer program, catch documentation and validation, and implemented VMS. It had mainstreamed EAFM in its plans/programs, including the National Tuna Management Plan, and was developing harvest control rules (HCRs) for all fisheries including oceanic tunas. Philippines noted that combating IUU was a focus of the new administration.

71. Indonesia noted that its port sampling programs was continuing, expanding to Gorontalo. In line with Indonesia's National Tuna Management Plan, Indonesia planned to develop a harvest strategy for tuna in its archipelagic waters with the assistance and involvement of WCPFC, ACIAR CSIRO, a local NGO and relevant experts. Indonesia had progressed to an authorised ROP provider and was more actively participating in SC including through contributing information papers stemming from collaborative activities between CFRD-Indonesia and ACIAR-CSIRO. Indonesia drew delegates' attention to SC12-ST-IP-05 (Symbionts of bigeye and yellowfin tuna as potential stock markers for tuna in Indonesian archipelagic waters) and SC12-ST-IP-06 (Characteristics of tuna fisheries associated with Indonesian anchored FADs in waters of the west pacific and the Indonesian archipelago), and SC12-SA-WP-01 (Population structure and provenance of tropical tunas: recent results from high throughput genotyping and potential implications for monitoring and assessment).

72. FSM noted that while Pohnpei has been FSM's main transshipment port, Kosrae was now in operation to unload and tranship, giving FSM two active ports. Port coordinator funding resulted in this expansion. FSM had increased the number of observers and certified debriefers.

73. Japan noted that for several years it had advised WCPFC about low skipjack tuna catch in its coastal troll fisheries. The offshore pole and line fishery and the purse-seine fishery face a similar problem. Japan advised that the total skipjack catch in these fisheries in the first half of 2016 was half of last year's total catch, which was almost the lowest recorded historically.

2.4 Reports from regional fisheries bodies and other organizations

74. Birdlife International provided some feedback on CCM's national reports regarding reporting on seabird bycatch, noting that: some CCMs are doing a good job reporting on their seabird bycatch as required by CMM 2012-07, and the table in Annex 2 was used by some CCMs. However, some CCMs appear to have assumed that because they do not fish in areas where mitigation is required that they do not need to report on bycatch. It was not clear from some CCM's reports how many hooks have been observed or whether bycatch observations were required of their observers. Birdlife International noted that seabird identification was an ongoing issue for some albatross species and some CCMs do not identify petrels and shearwaters at all, which was an issue as some species are vulnerable. CCMs were encouraged to improve bycatch data collection and detailed reporting to help assess total mortality across the WCPO and WCPFC can better assess the effectiveness of the mitigation required of its fishing fleets.

AGENDA ITEM 3 – DATA AND STATISTICS THEME

3.1 Data gaps

3.1.1 Data gaps of the Commission

75. P. Williams presented SC12-ST-WP-01, on the major developments over the past year in filling gaps in the provision of scientific data to the Commission. The review of gaps in 2014 and 2015 scientific data provisions included the assignment of a tier-scoring evaluation level, as directed by WCPFC11, and an overall evaluation of the submission of scientific data, as directed by WCPFC12. Three CCMs with fleets active in the WCPFC Convention Area had not provided 2015 annual catch estimates by deadline of the 30th April 2016 but these have now been provided. The issues previously reported in annual catch estimates have further reduced and the lack of any estimates for key shark species remains the main gap for certain CCMs. The timeliness of the provision of aggregate catch/effort data continues to improve with nearly all CCMs providing data by the deadline. The quality of aggregate data provided also continues to improve with a reduction in the number of data-gap notes assigned to the aggregate data in recent years. The main developments in the resolution of operational data gaps over the past year were the provision of 2015 operational data for the Japan tuna fleets (longline, pole-and-line and purse seine) for the first time, the improved coverage of operational data (2015) provided for the China tuna fleets (longline and purse seine) and the continued provision of operational data (2015) for the Korean tuna fleets (longline and purse seine). A revision to the longline observer coverage Table according to a. notifications provided by CCMs for their fleet and b. data submitted to WCPFC, was presented in response to a TCC11 recommendation (from SC12-ST-IP-02). It highlights discrepancies between what CCMs report as their coverage and submitted data. The UNDP-funded Sustainable Management of Highly Migratory Fish Stocks in the West Pacific and East Asian Seas (WPEA–SM) project provides WCPFC technical assistance to the Philippines, Indonesia and Vietnam to, *inter alia*, improve monitoring and data management of their domestic fisheries to the end of 2017. There has been good progress in the collection and provision of data from each of these countries in recent years. The paper lists some of the challenges that remain.

76. Some CCMs acknowledged continued efforts by Korea, China and Japan in providing operational catch and effort data.

77. FFA members observed that Indonesia and Chinese Taipei had yet to do so, and expressed the hope that they would do so. The provision of historical operational data was still to be addressed, with FFA encouraging CCMs to provide historical data.

78. Japan noted that it would continue to submit data for stock assessments in accordance with agreed rules, acknowledging that Japan holds the most valuable data set for this purpose. This CCM asked about the origin of the WCPFC public domain three-vessel rule.

79. SPC noted that the WCPFC public domain three-vessel rule dated to the time the WCPFC rules and procedures for the dissemination of data was established within the Commission.

80. EU welcomed the improvements in the provision of data, but queried the omission of its own observer data which did not appear in the paper's longline observer data coverage table. SPC indicated that size data had been provided, but not the detailed ROP-level of observer data and that this could be explained in the fringes of the meeting. This CCM supported efforts to expand the tier-score evaluation process and the new format for longline observer coverage. Regarding the public domain data issue which had been raised, EU supported the approach taken by IATTC, opining that the more data are made

available, while guaranteeing the appropriate level of confidentiality, the better it is for scientists working in this field.

81. USA noted that China has a quota for bigeye tuna but is only providing about 40% of its operational level data, and asked how China monitored catch against the quota with that level of logsheet coverage and when catch document schemes typically relate to the point in time when a vessel unloads, but there was an obligation to provide monthly estimates to WCPFC.

82. China explained that it has a quota for each vessel, including longline vessels targeting bigeye tuna in the tropical area, targeting albacore tuna mostly in temperate waters, and some in the overlap area. Some quota is allocated to the vessels targeting albacore. China sends monthly catch data to the WCPFC Secretariat and explained that it reconciles the catch document before catch is exported to Japan.

83. USA explained that as part of its national policy any data representing the activities of less than three vessels in a stratum cannot be released in the public domain. The WCPFC public domain three-vessel rule, when formulated, took this policy into account. USA noted that it does not envisage that policy changing in the short term to allow releases of information based on only one or two US vessels. USA further clarified that it does submit aggregated data to IATTC so the policy constraint is not relevant.

84. PNA members opined that provision of historical operational data was now the priority issue. These CCMs considered the approach taken by the US was a precedent and urged other CCMs to adopt the same practice or suggest alternative methods that would enable them to provide these data. For CCMs who had not yet provided historical operational data, these CCMs were asked to share the issues that kept them from doing so, and how those problems might be addressed so the data could be made available for the scientists.

85. Australia supported the new format for the longline ROP coverage table. Regarding key shark species, this CCM expressed some concern that catches might be unreported or under-reported, and asked SPC to elaborate on the type of investigations needed to get a better idea of those gaps.

86. SPC noted the issue in identifying under-reporting of key shark catches in the data submissions, acknowledging that the low longline observer coverage constrains its ability to evaluate this behaviour. SPC asked for direction from SC.

87. Australia suggested a comparison of the catch rates in logbooks versus observer data could provide a broad brush where there were major differences; it would provide a prompt to increase the observer coverage if possible. Australia suggested a supplementary paper on the topic would be useful.

88. Australia opined that SC should look at the three-boat rule from a scientific perspective as the limitation was a constraint, and expressed a preference that SC make a recommendation to make it less restrictive, noting that getting permission from other CCMs takes time.

89. USA clarified that it provides all the required operational data to SPC and WCPFC, but the data cannot be illustrated when there are less than three US vessels in an area. Regarding the observer coverage in Table 4 showing what was reported versus what was received by the WCPFC Secretariat, USA suggested a recommendation from SC12 could be for that table be forwarded to TCC12 and be assessed as part of the CMS. USA noted that SC2 recommended a minimum of 5% observer coverage. This CCM noted that it has been 4 years since a mandatory 5% minimum observer coverage came into effect and opined that it was time to review it, given the maturation of the needs of the Commission. USA

recommended that annual CVs be calculated for various taxa from 2012 to 2015 longline observer data and presented to SC13.

90. USA suggested that there may not be any products in the public domain that would require a fine scale illustration of two vessels or less.

91. SC12 agreed to form ISG-4 to discuss this and other data issues in the margins of SC12 and report back to plenary. The outcomes of this small working group on data were discussed under Agenda item 3.5.

92. The theme co-convenor advised SC that a number of information papers had been prepared under this agenda item: SC12-ST-IP-01 on estimates of annual catches in the WCPFC Statistical Area, SC12-ST-IP-06 on characteristics of tuna fisheries associated with anchored FADs in Indonesian archipelagic and Western Pacific waters, SC12-ST-IP-07 on group seine operations of Philippine-flagged vessels in High Seas Pocket 1 and SC12-ST-IP-09 on purse-seine fishing activities in PNA waters.

93. SC12 recommended that:

a) The paper SC12-ST-IP-02 is forwarded to TCC12, highlighting the gaps in ROP Longline coverage.

b) The Scientific Services Provider calculate annual coefficients of variation (CVs) for various taxa collected from longline observer data for 2013, 2014 and 2015, and present this information to SC13.

3.1.2 Species composition of purse-seine catches

a. Review of Project 60 outputs

94. N. Smith (SPC-OFP) presented SC12-ST-WP-02, a work plan for Project 60 for 2016-17. The objective of the project is to improve the collection and representative nature of species composition data for tuna (skipjack, yellowfin and bigeye) caught by purse-seine fisheries in the WCPO in order to improve the stock assessments of these key target species in the WCPO. Purse seine catch composition is highly variable spatially and temporally, and accurate estimates of total catch of the tuna species are an essential component of the stock assessments. Previous analyses have identified that grab sampling creates biases in the estimates of catch composition. Spill sampling has been developed as a less biased sampling approach – but there are practical difficulties in its implementation on some vessels. The associated paper SC12-ST-IP-03 provides annual estimates of purse seine catches by species based on alternative data sources using the same four methods used last year. It is intended that this update will occur annually in this manner until an agreement on a revised methodology can be reached. The work plan for Project 60 is intended to resolve an ongoing approach to sampling for purse seine catch composition. It consists of three inter-related work streams. The first is focussed on collating information to date, collecting new data and undertaking integrated analyses, attempting to obtain and utilise data from other sources at sea and in port. This work stream will analyse data not yet investigated from PNG in 2014 and identify key data gaps to address with additional sampling. Additional at sea sampling will occur with at least two key components – collecting additional paired spill/grab sampling data, and developing pragmatic approaches to implement spill sampling where it may not currently be practical. This combined data set will be utilised to undertake the investigative analyses required to deliver the project outputs in the third work stream to support monitoring in the medium term. The second work stream will explore other sampling approaches. In addition to trying to address practical issues with spill sampling, other approaches to collect unbiased species composition data from purse seine catches will be

investigated. Some options which will be explored are detailed unloadings data, and, electronic monitoring approaches. The third work stream will develop a medium term approach to monitoring catch composition, including a least-biased methodology to ascertain purse seine catch composition for ongoing use, standard observer sampling protocols including how best to sample catch where spill sampling is not practical, and a medium term plan for monitoring catch composition utilising the most appropriate mix of sampling approaches going forward (along with recommendations on the development of systems to support that ongoing monitoring). The recommendation from SC11 on producing catch composition using four methods estimates has been actioned and will continue. The SC was asked to note: the indicative work plan for Project 60 in 2016-17, that at-sea paired spill/grab sampling will also have a focus on resolving operational issues in the use of spill sampling, the intention to obtain high quality landing data to support the work, the intention to investigate alternatives to observer sampling, and, the intended project outputs. The SC was requested to endorse the work plan.

95. In response to some discomfort expressed by Japan about the seemingly indefinite nature of the project, SPC noted that one of the pieces of the proposed 2016-17 work would allow for better understanding about how long Project 60 should carry on. SPC noted that some form of monitoring of purse-seine catch composition needed to continue as part of ongoing fisheries monitoring.

96. FFA members support the continuation of Project 60, and recommended that species and size composition of purse-seine catches be undertaken using spill sampling by observers where practical. To provide comprehensive coverage where spill sampling is impracticable, these CCMs recommended grab sampling be continued as it can be corrected from spill sampling data. FFA members suggested the project undergo a change in focus to address operational practicalities along with more clearly defined outputs in the work plan. These CCMs suggested identifying vessels cannot undertake spill sampling and ascertain how this will affect coverage levels.

97. SPC noted that one intention of the project is to put observer protocols in place to address the issues identified by FFA members.

98. FFA members noted that the project's work plan included extending sampling to fleets, areas and set types where no representative sampling had taken place, expanding the dataset for investigating sampling biases correction in catch compositions. These CCMs opined that this should be undertaken in parallel with work to ascertain how to improve operational aspects of spill sampling. FFA members encouraged development of a standard observer sampling protocol and for SPC to complete the review of data collected to date, and expressed support for exploring other sampling approaches which could be tested on a vessel/trips sampled with observers and in-port unloading monitoring.

99. SPC noted that the analysis of all data collected to date was envisaged in the work plan as a priority task. SPC confirmed that dual or multiple use of time at sea was planned and would be used to investigate other sampling methods, operational issues and also potentially e-monitoring.

100. The theme co-convenor noted that the issues discussed under this agenda item were covered in the proposed work plan.

101. SC12 endorsed the work plan for Project 60, outlined in SC12-ST-WP-02.

b. Implementation of observer spill sampling

102. This agenda item was discussed during the review of Project 60 at 3.1.2(a).

103. SC12 recommended that the Scientific Services Provider proceed with the proposed work plan for Project 60 (Collection and evaluation of purse seine species composition data) as endorsed by SC12.

3.1.3 Potential Use of Cannery Receipt Data for the Work of the WCPFC

104. T. Lewis presented SC12-ST-WP-03, on the potential use of cannery receipt data for the work of WCPFC. The presentation described the potential use of cannery receipt data for the work of the Western and Central Pacific Fisheries Commission (WCPFC), and in particular, providing a means of validating the estimates of the purse seine catch by species using logsheet-reported catches adjusted with observer data estimates of species and size composition. The findings in this paper are based on a study funded by the International Seafood Sustainability Foundation (ISSF) which included a review of cannery receipt data provided by ISSF-participating processing companies to the WCPFC over the past 4 years. The WCPFC is currently conducting an extension to this study, targeting processors not covered in the ISSF study. Summarised data (tables and figures) are provided to show comparisons of the purse seine catch by species and size categories from observer and cannery data for years that complete data are available (2013 and 2014). The main findings of this paper were that there is clearly potential for using cannery receipts data to validate/compare species and size composition breakdowns by fleet determined from observer-derived estimates, provided the following applies: the consolidated total trip catch according to cannery data is consistent with the total trip catch from logsheets and observer data (that is, the data from canneries covering the entire trip are collected, compiled and available), and the cannery is recording species composition for all relevant size categories.

105. Australia asked whether, if there is 100% participation from the processors, the only outstanding issue is small fish and species breakdown.

106. Lewis noted that not all processors currently provide reconciliation. Lewis advised that obtaining the other 50% of catch that is being processed through the canneries was the key, noting that because of partial unloading entire trip catch is not represented in the available cannery data.

107. In response to queries from Indonesia about the driver for collection of cannery data, noting that tools exist that address the same issues (e.g. sampling, observers and other metrics), Lewis noted continuing uncertainty of bigeye tuna catch estimates. There was bias in the grab sampling approach, and while there were expectations spill sampling could resolve these bias issues, there was uncertainty in obtaining accurate species composition estimates at the trip level. The processing data looks at 100% of landed fish. While a portion of the catch is sometimes not sorted by certain processors, the processor data is more comprehensive data set. Lewis noted that double counting was not an issue as they are separate datasets.

108. USA agreed that the paper could have elaborated on the benefits of using this information, and considered it premature to talk about a CMM or other mechanism for obtaining this information as information will be forthcoming next year. USA noted that costs would need to be considered before it could support such a proposal. USA advised that it requires vessels to gather this information but it can take some time to get it, so an appropriate timeframe would need to be agreed, as well as decisions around what data fields would be included before CCMs could determine what was practical, and to seek industry buy-in.

109. PNG noted that future work on traceability for CDS would need species/size composition data.

110. Lewis noted that most major markets, especially the EU, required separation of species, where only one species can be placed in a finished product. Some of the same information needed to be collected for traceability and CDS, but that was for commercial entities to undertake.

111. The theme co-convenor observed that this was an opportunity to make use of a data source that could validate the current estimates based on observer data, since no other source of data available.

112. FFA members supported the use of this data and requested SPC to provide an estimate of the feasibility and indicative costs of obtaining cannery data which met the criteria set out in the working paper and an estimated timeframe to get 100% of cannery data submitted, acknowledging that obtaining 100% coverage from all canneries may be a challenge. These CCMs requested SPC to advise what percentage of total cannery landings would be required to provide species and size composition breakdowns by fleet.

113. SPC would consider the request, noting that because partial unloadings are distributed among canneries it was likely that data from all canneries would be needed; the timeframe was currently unknown.

114. Japan made the observation that cannery data would not cover all tuna landings, and voiced similar reservations to USA on the recommendation proposing a CMM. While Japan supported the approach, it advised that as information would be collected from industrial purse-seining companies, more information including about what improvements could be expected would be helpful for those discussions.

115. Lewis observed that the primary reason for a mechanism to *require* the information was because it is done by non-ISSF companies on a voluntary basis. If it was desirable to collect this information, the Commission would need to consider how it could be obtained.

116. Asked about the contribution of this data to the scientific work of the Commission, Lewis observed that it would provide matched data sets of cannery and observer data at the trip level. Within the cannery data there is full resolution of size and species composition which is not obtained with the observer data at the trip level. This complementary information provides better information for use in stock assessments. Regarding the reconciled (QandQ) data, Lewis noted that this type of information are also available in the final out-turn or equivalent data provided by USA and other CCMs. If the Commission wants to compile these reports into a comprehensive database, obtaining the final out-turn data at the trip level, i.e. from the government agency that collects the information at landing on behalf of their fleet, was needed.

117. Lewis noted that one or two fleets already provide final out-turn data to this project.

118. Australia observed that the current 50% coverage of processors meant only about 5% of the data is useful and asked what level of processor coverage was needed to get a reliable sample.

119. Lewis noted the data are a partial representation of the total trip catch. In the 2015-16 data, the coverage and quality of the data increased, though it has not been analysed yet. It is likely that closer to 25% of data for these years may be useable; partial unloading remained the main barrier. Lewis suggested that a plan might be to present further results at SC13, looking at the potential usefulness.

120. EU welcomed the project's continuation and opined that traceability and CDS are part of the work of the Commission, which was currently developing a CDS for key tuna species for which this work was relevant.

121. Lewis thanked the EU for funding the extension to non-ISSF canneries.

122. The theme co-convenor observed that SC12 agreed that cannery receipt data was useful and there was interest in continuing this work, but that it was premature to look at the mechanism for requiring this information.

123. SC12 recommended that WCPFC continue the work which would include exploring mechanisms for obtaining complete cannery receipt or equivalent data for validating the purse seine catch and evaluating the usefulness of these data.

3.2 Regional Observer Programme

3.2.1 ROP longline coverage

124. This was discussed under Agenda item 3.1.1.

3.3 Electronic monitoring and electronic reporting

125. The 2nd WCPFC Electronic Monitoring and Electronic Reporting Intersessional Working Group Meeting (ERandEM-IWG-2) was held in Bali, Indonesia from 1-2 August 2016. The outcomes of the workshop were introduced by the Chair of the ERandEM-IWG-2, K. Smith (Australia). The Chair of the ERandEM working group referred SC to SC12-ST-WP-07, which outlined the agreed recommendations from the working group. Following presentations by CCMs on their ERandEM initiatives, there was a discussion about ensuring sufficient resources were allocated to ensure the WCPFC Secretariat and Science and Data Services Provider can support CCMs in their development of national information management systems. The group also recommended that the WCPFC Secretariat and SPC undertake some specific tasks over the next 12 months and report back to ERandEM WG 3. The Working Group noted that the Science and Data Services Provider had refined the draft data standards for catch and effort reporting and observer reporting following feedback from some CCMs and commercial service providers. The Working Group noted that the standards do not change the data fields adopted by the Commission but document the required data standards and formats to ensure electronic data submission to the Commission is standardised. Documented data standards for electronic reporting will ensure that data is able to be accepted into the Commission's databases in a timely manner and will ensure the efficient use of resources within CCMs national administrations and within the WCPFC Secretariat and Science and Data Services Provider. The Scientific Committee endorsed the draft standards and recommended that they be forwarded to TCC12 and the Commission. The Scientific Committee also recommended that comments on the draft standards be provided by CCMs to the WCPFC Secretariat and Science and Data Services Provider by 3 September to enable any comments to be collated and circulated to all CCMs prior to TCC12. In endorsing the standards, the Scientific Committee recognised that the standards would be updated by the WCPFC Secretariat and the scientific services provider to reflect decisions of the Commission and the Secretariat would notify CCMs via circular when updates are made. In relation to electronic monitoring (EM), the Working Group heard from those CCMs that had continued to trial EM technologies and noted that considerable progress had been made in the past 12 months with one CCM (Australia) implementing EM in some of its domestic fisheries. The Working Group recommended that a concept paper be developed that described how EM could be used to support data collection efforts by CCMs and what standards needed to be developed at the WCPFC level, and how the various collection efforts could complement each other. The working group reviewed progress against the workplan in the TOR and considered that some progress had been made but further work was required and recommended that the group continue its activities under the existing TOR and meeting again in 2017 in conjunction with SC13.

126. The Scientific Committee endorsed the recommendations as outlined in SC12-ST-WP-07 (Agreed recommendations from ERandEM-WG2).

127. The theme co-convenor noted that the ERandEM working group had agreed a number of recommendations.

128. FFA members noted the progress made at the workshop and considered it a valuable process in ensuring the adoption of regional e-reporting and e-monitoring standards. These CCMs suggested that CCMs provide comments to the Secretariat by 3 September to provide sufficient time for comments to be compiled and posted on the secure site, to be reviewed before TCC12. FFA members found it positive that no significant concerns were raised about the proposed e-reporting standards and were optimistic that they will be supported at WCPFC13. Several CCMs were well advanced in implementing e-reporting and adopting the standards would ensure consistency in reporting. SC's focus should be on ensuring that existing data collected can be submitted electronically, in a standard format which can be assimilated into databases.

129. The WCPFC Compliance Manager confirmed that this was achievable for the Secretariat.

130. PNA members expressed support for the working group's recommendations but emphasized the importance to PNA members of para. 4. Through the PNA FIMS, electronic logsheet reporting was in place that would cover more than 1 million tonnes of catch in 2016. In addition, observers were reporting electronically on most of this fishing and electronic catch documentation reporting was also being rolled out, along with other electronic forms. PNA members stressed that it was essential to PNA that the North Atlantic Format (NAF) was fully catered for in the development of e-reporting standards.

131. The theme co-convenor noted general support for the recommendations, including the suggestion from FFA, and thanked the Chair of the ERandEM working group for facilitating the workshop. He advised that SC12-ST-IP-04: an update on the implementation of electronic monitoring and electronic reporting technologies in the WCPO and SC12-ST-IP-07: group seine operations of Philippine-flagged vessels in High Seas Pocket 1 were relevant to this agenda item.

132. SC12 supported outcomes and recommendations from the second meeting of the WCPFC E-Reporting and E-monitoring Working Group (ERandEM WG-2, August 2016) and that they are taken forward to TCC12.

133. SC12 noted that CCMs agreed to provide comments on the draft WCPFC E-Reporting standard data fields for logsheet and observer data prior to 10th September 2016, so that the WCPFC Secretariat and Science Services Provider can compile comments for presentation to TCC12.

3.4 WCPFC-funded Port Coordinators

134. The WCPFC Compliance Manager gave some background on the WCPFC-funded trial port coordinators programme which was established in 2014 for 2 years. The Compliance Manager noted that one of the tasks for SC was the review of the progress of the programme and provides a recommendation. The port coordinators programme gave five Pacific Island port states to submit an invoice annually for a small contribution from WCPFC towards funding a port coordinator and equipment costs. Three PICs had taken up the offer; the CCMs which had not felt they had adequate funding without the contribution. Each national fisheries agency decides how to use the money to fill gaps within their own programme and each country utilised the contribution in different ways within the scope of the program. The WCPFC Compliance Manager noted that funding provided under the program has gone into national activities that

have improved sampling and other coordination activities. One of the members that had received a contribution had submitted a report (FSM), which was attached to the SC12-GN-IP-04.

135. FSM thanked the Commission for the funds provided, and advised that it had been used for various administrative and logistical activities. FSM was in discussions with SPC about collecting data. This CCM recommended the programme to other port states that wished to trial port coordinators.

136. Kiribati noted that it had accessed funding last year and would access more funding this year. It had been helpful in recruiting new observers for data collection.

137. USA thanked FSM for providing a report, and noted its preference that the other two CCMs which had accessed funding also provide reports.

138. PNG advised that it could provide a report.

139. FFA members noted that the monitoring of fish from purse-seine unloadings into local communities was occurring, and asked for suggestions for monitoring these activities.

140. SPC indicated they would follow-up and compile more information to be made available at a later date.

141. FFA members supported the continuation of the program and noted efforts to expand. The Cook Islands was also investing in port monitoring programmes across its national and foreign ports (Pago Pago). FFA members noted proposed amendments to the Scientific Data to be provided to the Commission would require CCMs to bolster monitoring programmes to ensure they are able to verify operational catch and effort data and considered that resources and technical capacity development in support of national monitoring programmes should be supported by the Commission before making verification procedures mandatory. The Commission should consider expanding the programme to other interested port states.

142. Fiji noted that it is building up the capacity of its port monitoring programmes. This CCM noted that some of the countries involved in the trial have administrative and logistical implementation challenges.

143. The Compliance Manager observed that there was support for continuing the program and that consideration should be given to broadening the scope. The Secretariat suggested that it could work with SPC and interested CCMs with a view to taking an outcome to the annual meeting with an SC recommendation and TCC comments.

144. SC12 recommended that the WCPFC Secretariat consider the requests of several CCMs to expand the support of the Port Coordinators initiative and report a proposal at TCC12.

3.5 Review of Scientific Data to be provided to the Commission

145. EU introduced SC12-ST-WP-05, this CCM's July 2016 revision of a proposal for an amendment of the Scientific Data to be provided to the Commission. This CCM observed that TCC struggles every year with the assessment of the compliance with some of the Scientific Data to be provided to the Commission. This CCM brought to the attention of SC that the interpretation of the provisions under the Scientific Data to be provided to the Commission is quite different at TCC than at SC, with difficult and inconclusive discussions mainly around what is compulsory and what is not. While it was not a scientific matter, this CCM opined that SC should give some guidance to TCC about what is required and what can

be considered optional and could facilitate the work of TCC. EU noted that it had received some comments on its proposal and hoped to be able to discuss the proposal with other CCMs then come back to plenary with a way forward.

146. Japan asked for clarification about what SC was being asked to do, noting that where something was mandatory and non-mandatory was of a legal nature. Japan suggested that SC12 should not say a CCM has to provide information if there is a constraint domestically and asked for clarification around the goal.

147. The Compliance Manager noted that it was a tasking TCC11 had given EU. It was noted that the issue of whether something is mandatory or not has resulted in difficult discussions in TCC which have flowed into the Commission meeting as it created problems completing the final Compliance Monitoring Report. The proposal required review by SC12, which was tasked to provide feedback.

148. Both Japan and USA preferred to discuss the issue in an ISG in the margins of SC12.

149. China noted that it encourages fisherman to release large manta rays caught on branch lines but some fish are in the water and cannot always be identified so it was difficult to provide this catch data.

150. SC12 agreed that ISG-4 would discuss this issue plus the item raised under Agenda item 3.1.1 (consideration to update the definition of public domain data). New Zealand agreed to chair it.

ISG-4 – EU proposal amending the Scientific Data to be provided to the Commission

151. ISG-4 was tasked with looking at the proposal to modify the definition of the WCPFC public domain data to align to the IATTC definition, and the EU proposal for an amendment of the Scientific Data to be provided to the Commission (SC12-ST-WP-05). L. Olsen, the convenor of ISG-4, reported on 9 August that the group met four times during SC12. A report of the meeting was tabled for SC12's endorsement, with changes to section 3 (Dissemination of Public Domain Data) to be forwarded to WCPFC13 for consideration. Regarding Scientific Data to be provided to the Commission, some amendments had been agreed while others had not. It was agreed that all the data were important, but there were matters which TCC needed to deliberate on. New Zealand agreed to continue to lead on these matters at TCC12. SC12 adopted the ISG-4 report on data.

152. SC12 noted the work of the SC12 informal small working group on data (ISG-4) and that the recommendations in the report of ISG-4 (available as SC12-ST-WP-09_rev2) are taken forward.

a) With respect to “the proposal to modify the definition of the WCPFC public domain data to align to the IATTC definition”, the changes proposed by ISG-4 are to be forwarded to TCC12 for consideration.

b) With respect to the review of the elements proposed in SC12-ST-WP-05, [\(European Union EU-proposal for an amendment of the "Scientific data to be provided to the Commission"\)](#), the revised document by ISG-4 are to be forwarded to TCC12 for further work.

3.6 FAD Management Options Intersessional Working Group

3.6.1 – 3.6.3 FAD research plan; Update on consultancy on FAD marking and identification of FADs; and FAD data to be provided by vessel operators

153. B. Kumasi (PNG), the FADMgmtOptions-IWG Chair, introduced Shane McGrath who was part of the consultant team looking at FAD marking and identification and invited CCMs interested in bringing any issues to the attention of the consultative team to engage with him. The FADMgmtOptions-IWG Chair drew SC's attention to SC12-ST-WP-06 and SC12-ST-WP-08, the draft proposal for a research plan for the FAD-IWG and the initial compilation of logsheet data fields. An update was presented on the work of the group and sought feedback from SC12 and intersessionally in the lead-up to TCC and the next session of the FADMgmtOptions-IWG in September. The FADMgmtOptions-IWG Chair thanked SPC and the Secretariat for the work it had undertaken intersessionally. Four papers were ready for the working group's consideration and a draft skeleton research plan had been put up.

154. USA noted that the FAD logbooks are meant to be based on the WCPFC ROP Minimum Standard Data Fields but some duplicate fields were identified in the draft research plan. Also, a couple of the fields appeared limited in utility (for example 'page number'). As the Commission moved forward to e-reporting and e-monitoring, making sure the fields collected were consistent without unnecessary duplication with what is already collected by observers was important; each field should have scientific merit and utility.

155. The FADMgmtOptions-IWG Chair noted this had also been raised by one of the NGOs and explained that the reasoning for them being a complementary field on the log forms is have a second data source for verification purposes.

156. EU agreed with the priorities for the research plan as set out in the working paper, noting that it made sense to prioritise something immediately workable as hotspots analysis and fleet behaviour, using observer data. Both research areas are critical. EU noted that it was already providing funding to assist part of this work. EU considered acoustics and FAD design priorities too but indicated that both research areas were already being undertaken by some parties. EU had provided the FADMgmtOptions-IWG Chair the IATTC FAD working group draft logbook, which was a joint work of national scientists, purse-seine captains and the IATTC scientific staff. One of the main issues was to provide something practical and simple for vessel captains, which complements information being collected by observers.

157. FFA members considered this area of work to be informative for management decisions for the tropical tunas and key shark species, and asked SC12 to support the FADMgmtOptions-IWG Chair to further develop the research plan ahead of the next meeting of the group after TCC12. These CCMs requested the timely prioritisation of the construction of a comprehensive data set on purse-seine target and bycatch species catches, which identifies FAD-associated catches to inform research plan by identifying key issues and gaps in the data. In turn, the data and its subsequent analyses would inform the development of a new tropical tuna CMM. SPC would also benefit from this work. Aspects of the plan provided for better understanding of drifting FAD-tuna dynamics. FFA members suggested that the research plan consider the costs and timeframes of each proposed activity, suggesting that for activities not already funded or underway, the FADMgmtOptions-IWG could consider FAD research being undertaken in other tuna RFMOs and explore possibilities of support from the fishing industry and NGOs.

158. Japan supported the research plan and stated a preference for a FAD research plan for bigeye management.

159. Regarding FAD (identification) tags, USA noted that consistency with developments in IATTC should be considered, as boats go back and forth between the WCPO and the EPO. This CCM was supportive of the research but noted the need to ensure confidentiality and perhaps the consideration of a

time lag. This CCM noted the administrative burden on fishers, and that USA would need to go through processes nationally regarding creating another logbook.

160. EU noted that standardisation of purse-seine CPUE is a key issue for the stock assessments, and should be more explicitly stated in the research plan.

161. PNA members reiterated their view that much of the data on details of FAD construction and other related information was better provided by the vessel operator, not the observer.

162. The FADMgmtOptions-IWG Chair noted that work would be undertaken to review the fields with respect to the ROP minimum observer data fields. The consultancy with respect to the work on FAD marking and identification had been awarded, with the draft report expected to be presented at TCC12.

163. The theme co-convenor reiterated the FADMgmtOptions-IWG Chair's request that further suggestions for the work in the lead-up to the working group meeting after TCC12 be forwarded.

164. SC12 endorsed the work and the FADMgmtOptions-IWG work plan.

3.7 Economic data

165. M. Skirtun presented SC12-ST-WP-04, analyses and projections of economic conditions in WCPO fisheries. Using ex-vessel fish prices, fishing costs and catch rates, economic conditions indices were constructed for the southern longline, tropical longline and purse seine fisheries of the WCPO. The indices provide an illustration of the prevailing environment for the generation of economic returns, without addressing the absolute level of returns generated or how they are distributed. A historical overview for the reference period from 1997-2015, and simplistic ARIMA projections to 2025 were presented. For the southern longline fishery, conditions have fluctuated over the reference period but the general trend is one of decline owing to declines in catch rates and increases in fishing costs. Projections based on past trends suggest persistent below average catch rates will be the key driver behind the continuation of relatively poor economic conditions for the fishery. For the tropical longline fishery, economic condition rapidly declined between 1997 and 2008 as costs increased and prices and catch rates fell. Conditions improved in 2009 as costs declined thanks to a drop in the global fuel price and an increase in catch rates, but conditions remained persistently stable at below average levels since 2011. Going forward, economic conditions are projected to improve slightly in the initial years of the projection period before declines in the catch rate and prices drive economic conditions back to below average levels. In contrast, economic conditions in the purse seine fishery have been on an upward trend since 2006. The key driver behind this was above average fish prices and increasing skipjack catch rates. Conditions are projected to improve significantly over the next 10 years on the account of higher projected catch rates and above average fish prices

166. FFA members recognised that this work was not fleet specific, providing an overall indication of the economic conditions of the major WCPO fisheries. It highlights concerns expressed by some CCMs, including FFA members, relating to declining bioeconomic indicators for the southern longline fishery and the impact of low catch rates on the economic viability of, in particular, FFA's domestic fleets. It was noted that while albacore prices were relatively stable over time and fuel prices were currently low, low catch rates were still having an effect on profitability. If status quo was maintained, CPUE would continue to decline and uneconomical conditions would force more vessels to exit the fishery. These CCMs warned that the same trend was inevitable for the tropical longline fishery where, over time, economic conditions were projected to fall below the long term average. FFA members observed that SC should do more work on economic conditions in WCPO fisheries and provide advice to the Commission to ensure management approaches achieve levels of CPUE that support long term stability and operational

viability. FFA members suggested that the ISG considering amendments to the Scientific Data to be provided to the Commission consider what type of economic data might be useful, including developing harvest strategies and management measures, and recommended that an annual update of this working paper be provided to SC.

167. Chinese Taipei asked for clarification about fish prices in the presentation and asked if prices were monthly, seasonal (quarterly) or annual, as fluctuations in prices within a given year can have a considerable impact on profitability. This CCM suggested that if annual prices are used, they should be weighted to better reflect their contribution to profitability.

168. Skirtun confirmed that the study used annual prices, noting that for the purse-seine fishery the price is often negotiated two months in advance. Skirtun took the point that prices do not reflect the seasonal component and noted it could be looked at in future work.

169. Chinese Taipei commented on the common shortcomings of time series forecasting methods, which are generally associated with increasing uncertainty projecting further into the future, and asked if the issue was captured in the analyses and how it was accommodated.

170. Skirtun noted that most of the projected series are associated with increasing 95 per cent confidence bounds reflecting the increase in uncertainty. Skirtun also noted that trending or non-stationary data was a problem in projecting macroeconomic time series variables but confirmed that all the variables were stationarized when the values were projected. The authors did not use nominal or increasing trend data.

171. Cook Islands agreed that the Commission should be collecting data that would help evaluate the effect of management strategies upon the potential economic viability of fisheries and which allows indicators of economically-informed target reference points (TRPs) or management objectives to be monitored. SC should consider data requirements for the voluntary submission of economic data by CCMs.

172. In response to a general statement about the kind of economic data that should be collected, Skirtun stated that the fishing costs index was predominantly made up of fuel costs. The non-fuel index was kept constant in real terms, i.e. increasing at the same rate as the USA CPI. Skirtun noted that the projections could be improved with better information on changes in the key cost items for non-fuel operating costs.

173. In response to a question from Indonesia regarding whether the CPUE in the paper was standardised or nominal, Skirtun responded that she understood it to be standardised. During the meeting, Skirtun was able to confirm that the CPUE in the paper was in nominal terms. This correction was not provided orally to SC12 but is provided here for completeness.

174. In response to a question from Indonesia about FADs, Skirtun commented that the model did not break CPUE calculations down by FAD or non-FAD sectors, it used catch divided by total fishery effort.

175. Some CCMs noted that access fees should be included in future analyses, using the latest access fees figures available, as it was an important factor for DWFNs in analysing economic conditions. It was also noted that prices may be confidential for industry.

176. Skirtun clarified that the purpose of the analysis was to look at the relative prevailing environment to generate profit in the fishery, rather than absolute levels of profitability or who captured the returns.

177. SC12 recommended that:

- a) An annual update of “Analyses and projections of economic conditions in WCPO fisheries”, in a similar manner to SC12-ST-WP-04, continue to be provided at SC meetings.**
- b) These economic analyses be made available to, and be used by, the Commission in the development of harvest strategies and management measures.**
- c) SC13 considers guidelines for the voluntary submission of economic data to the Commission by CCMs, recognizing the value of economic data to the work of the Commission.**

AGENDA ITEM 4 – STOCK ASSESSMENT THEME

4.1 WCPO tunas

4.1.1 WCPO bigeye tuna (*Thunnus obesus*)

4.1.1.1 Review of research and information

- a. Research on population structure of tropical tunas

178. P. Grewe (CSIRO) presented SC12-SA-WP-01 on population structure and provenance of tropical tunas: recent results from high throughput genotyping and potential implications for monitoring and assessment. P. Grewe described a strategic program of work using next generation sequencing (NGS) genetic methodologies to answer applied fisheries questions relevant to WCPFC-managed tuna species. The presentation provided an overview of research for estimation of spawning-stock biomass, using close-kin mark-recapture, studies of stock structure/provenance (e.g. SC12-SA-IP-02), gene-tagging and species identification assays for eight *Thunnus* and skipjack tunas. The results presented demonstrate the potential for using a DNA based assay that can ascribe an individual fish at three levels: i) Species (confirmation of sample identity); ii) Provenance (region of birth); and Individual (DNA fingerprint profile). The presentation highlighted a number of fishery applications of NGS technology including chain of custody and provenance of fish to identify and deter IUU fishing.

179. In response to a question from USA about Coral Sea and western Pacific yellowfin tuna stocks, and whether the Mooloolaba stock may be resident, Grewe explained that it was a possible interpretation. Sampling larvae was too difficult so his team sampled longline catch including 4, 5 and 6 year old animals from the spawning grounds then and more recently a sample of adults from the same reef system that were in the act of spawning. Given there was not much difference between them, this may imply there is a local Coral Sea stock, but this needed to be put in context with sampling of additional spawning phase adults from Fiji, Solomon Islands, PNG. This work was being extended by a new study (SC12-SA-IP-15).

180. Indonesia thanked CSIRO and ACIAR for their engagement with Indonesia and for genetic methods training, and hoped there would be further collaboration. Indonesia asked for an estimate of how long it would take to get good results and what factors affected the time needed for comprehensive results.

181. Grewe commented that CSIRO was taking a cautious approach to completing the analyses as the ramifications were so important. For the close kin project (2006-2010) it took an additional two years to quality check and refine the data analysis. A preliminary result should be available for the November 2016 ACIAR workshop. They hoped that within six months of that there would be a final completion report.

182. In response to a number of questions about the sampling from J. Hampton (SPC), Grewe made a number of comments: genetic methods (for example, gene tagging) offers fishery independent data; if larvae cannot be sampled then taking adults is sometimes the only way forward. However, sampling adults may in fact sample a mixed population of feeding adults that could provide strange or ambiguous stock structure results – in Tokelau, the sampling was 30-40cm fish and in the Coral Sea (Mooloolaba) and Baja California (Eastern Pacific near Mexico) they sampled larger, adult fish (4, 5, and 6 year olds). Preliminary results published (see SC12-SA-IP-02) this did not appear to indicate mixed populations were sampled for the published study. Regarding a question about pilot scale gene-tagging project underway for southern bluefin tuna (SBT), Grewe commented that the crew were already experienced at conventional tagging and indicated gene-tagging was similar throughput to conventional tagging operations. Also noted that CSIRO were working to further optimize gene tagging tools and protocols. The crew was able to sample 1,000 SBT a day but this was limited by ability to finding schools of appropriate sized fish. The solution for larger populations which were much more broadly distributed was technical – it might mean using additional boats and samplers. Gene tagging even worked out a less expensive exercise compared to conventional tagging and will only get cheaper as cost DNA technology was rapidly continue to fall in cost. To determine how many to sample, each fishery had to be considered on an individual basis. For North Atlantic herring, the team was considering a sampling of 100,000 fish per year for their tagging operation. For close-kin biomass abundance estimates, Sharks posed interesting problems with each species having its own challenges in terms of availability of adult and juvenile samples: white sharks are hard to access as adults so the project concentrated on using juvenile DNA to examine siblings and half-sibling relationships for abundance estimates. A close-kin abundance estimate is currently being examined for School sharks where juveniles and adults can be sampled from the fisheries and within nursery areas around New Zealand, Tasmania and the Great Australian Bight. Speartooth shark, an endangered freshwater shark species recently examined by CSIRO had very low genetic variation and only the juveniles were accessible.

183. FFA members endorsed the recommendations in the working paper, to a. develop a coordinated sampling strategy and program of work to analyse the stock structure of tropical tuna species using next-generation sequencing approaches, and b. secure partners to assist with funding it; these CCMs noted that the Commission was overstretched and SIDS already found it difficult to justify their existing contributions, particularly when compared to other regional organisations. FFA members asked SPC if the samples collected for the tissue bank were compatible with the genetic sequencing work.

184. SPC responded that the samples in the tissue bank can be utilised for these studies but as tissue bank samples are collected opportunistically, to contribute substantially to such a study the observers would need to be re-tasked to specific sizes, areas and times of year.

185. PNG noted that between 2001-04 Indonesia used genetics to look at a shared stock, and asked to what extent the genetic marker results were absorbed into the management framework.

186. Grewe sought to make enquiries, noting he was not working on shark genetics at that time.

187. Indonesia commented that the genetics collaboration between ACIAR and Indonesia covered just tropical tuna species.

188. FFA members that there was an emerging need to develop specific criteria for determining when a species is considered to have distinct stocks in the Convention area and pointed out risks associated with hasty judgements either to divide or merge stocks, for example if the Commission applied different management measures in different areas, only to find out that actions in one area impact the same species in another area. These CCMs proposed that such criteria and refinements to assumptions about the ranges of individual tuna stocks could be discussed by SC in future, to put in place an orderly process before next-generation sequencing methods start producing clear recommendations.

189. Philippines recognised the importance of the work in identifying population structures and informed SC that it is conducting similar studies on yellowfin tuna in the Philippines area (see SC11-SA-IP-11). Philippines was willing to collaborate on genetic work regarding the three tuna species.

190. USA asked whether the close kin genetic tool could be incorporated into an integrated stock assessment model like MULTIFAN-CL as a likelihood component for absolute abundance.

191. The theme co-convenor noted that it was being used for SBT by Rich Hillary.

192. Fiji noted the possibilities opening up in this area, including for information-poor species.

193. Theme co-convenor commented that SC12 recognised the importance of such projects. SC12 could encourage the continuation of such research on population structure which was valuable for effective stock assessments, noting that balancing cost was also a consideration.

194. Some CCMs noted that it was unclear what species should be prioritised and what the cost would be for sampling and analysis. Several CCMs had undertaken close kin analysis on Pacific bluefin tuna.

195. EU commented that projects would need to be defined as well as funding. Next steps could be to look at the objective of the analysis (i.e. stock structure or abundance) and develop a feasibility study. A multi-year funding system could be developed, subject to the outcomes of the feasibility study.

196. SC12 reviewed the recent results from high throughput genotyping and potential implications for monitoring and assessment of tropical Pacific tuna species. SC12 noted the importance of actions to be continued for: i) further development of a coordinated sampling strategy and analysis program for stock structure; ii) establishing a process for funding implementation and prioritization.

b. Improvement of MULTIFAN-CL software for stock assessments

197. G. Pilling briefly introduced SC12-SA-IP-07, and noted that SPC was available during the meeting to answer any queries relating to the progress of ongoing work to improve the MULTIFAN-CL software.

198. Theme co-convenor H. Nishida thanked SPC for preparing the paper and noted the efforts to improve the MULTIFAN-CL software and expand its features, in light of the bigeye tuna stock assessment review.

c. Update of WCPO bigeye stock assessment information

199. G. Pilling (SPC) presented SC12-SA-WP-03, a compendium of fisheries indicators for tuna stocks not assessed in 2016 (bigeye and yellowfin tuna), concentrating on those indicators for bigeye tuna in the WCPO. The indicators documented included: total catch by gear, nominal CPUE trends, spatial distribution of catch and associated trends, size composition of the catch and trends in average size. Noted

patterns for 2015 included a reduction in overall bigeye catches compared to recent years in both the longline and purse seine fishery, and reductions in 2015 catch rates in key purse seine set types but some increases in the catch rates of some longline fleets. In addition, a preliminary examination of the potential influence of oceanographic conditions on recent catch rate trends was presented as a work-in-progress, given the unexpected reductions in purse seine catch rates in recent years despite more easterly fishing patterns under strong El Niño conditions. In addition, short term stochastic projections were also performed to assess potential stock status in 2016 in light of recent catch and effort trends. These indicated no improvement in bigeye tuna stock status by 2016 under recent levels of fishing.

200. Japan asked for some further explanation around bigeye tuna CPUE trends, noting that purse-seine effort had declined overall, especially for key fleets.

201. SPC noted that in 2015 certain fleets moved out of the central western Pacific into other areas, but did not know the operational reasons behind this and would be pleased to receive more information on this.

202. Australia noted that the CPUE for drifting FAD and log-sets shown in Figure 4 had been reasonably correlated for most of the time-series but recently there had been a substantial decline in the CPUE on drifting FAD sets while the CPUE on log sets had increased. Australia wondered whether drifting FADs and logs might be in different parts of the ocean. In addition, Australia noted that interpreting change in indicators can be greatly assisted if they can be plotted against reference values, and asked whether it would be useful to adopt such an approach in future when presenting indicators for the WCPO, to assist SC to identify exceptional events when indicators break out of a band of normality. This was used in CCSBT.

203. SPC responded that there may be a spatial difference in the location of drifting FADs and logs, noting that logs were often closer to islands from which they originate. SPC would look at including reference levels in future versions of the working paper.

204. In response to a question from EU about changes in recent years in the way effort is reported by purse-seiners, SPC noted that approximately three years ago the increased reporting of transit days in logsheets for some fleets was first noticed, days which SPC does not include within its calculations of effort and hence artificially increasing CPUE. The trend of increased reporting of transit days has remained relatively constant, and the CPUE patterns in those years are likely consistent as a result, though there will be longer term influences of this change in reporting.

205. Anticipating the yellowfin tuna and bigeye tuna stock assessments next year, USA observed that the CPUE was very influential for non-skipjack tuna, and that typically latitude and longitude co-variate were included within the standardisation process. The USA asked whether oceanographic information could be included and requested that the projections include a plot for fishing mortality relative to F_{MSY} for yellowfin and bigeye tuna, comparable to that included for SB/SBF=0.

206. SPC noted that they have been increasingly using oceanographic influences in the CPUE standardisations and would plan to investigate the inclusion of this within the upcoming assessments.

207. Chinese Taipei followed up on Japan's query about key fleets. Noting that El Niño has had an effect on bigeye tuna distribution, which has moved eastwards outside of the traditional WCPO boundary, Chinese Taipei asked if this would affect the stock assessments in the future.

208. In response, SPC noted that the results in the Pacific-wide bigeye tuna stock assessments in 2015 for the WCPO region were consistent with those of WCPO-specific stock assessments. SPC observed that with the ENSO state moving back to neutral conditions, the impacts would likely average out over time.

209. Noting the projections presentation by SPC and remembering that at last year's Commission meeting the message to managers was that the current measure would recover the stock above the LRP by 2032 under status quo conditions, Japan asked if that was still the case and whether SC should give the Commission any further message about the prospect for bigeye tuna.

210. SPC responded that the difference between the two analyses is one of timeframe, noting that the presentation showed the results of short term projections through to 2016. If those projections were extended further, the stock starts to recover under status quo conditions, and over the longer period recovers to above the LRP on average, i.e., while the stock was projected to be below the limit currently, if positive recruitments continue the stock is projected to recover above the LRP in the longer term.

211. In response to a query from Indonesia relating to the treatment of Philippines ring nets in the catch and size of bigeye tuna 2010-2015 (Figure 9 of SC12-SA-WP-03), SPC agreed to seek further information on whether ring nets were included under 'other gear' in the size frequency distribution. Following investigation, they confirmed that ring net catch and size data were included within other gear ('Indonesia-Philippines' on that plot).

212. In light of El Niño conditions and the migration of bigeye tuna, Korea suggested a cooperative study with IATTC for the next stock assessment.

Retrospective analysis

213. R. Scott (SPC) presented SC12-SA-WP-02, which describes a retrospective analysis of the 2014 bigeye tuna reference case assessment for the period 2012 to 2007 and a subsequent hindcasting analysis using both deterministic and stochastic projection approaches to determine the robustness of the stock assessment to varying quantities of data and to determine the quality of the projections in terms of their ability to provide consistent estimates of stock status. The results show no evidence of any systematic over- or under-estimation of bigeye adult biomass with successive assessments. Estimates of stock status in 2012 and recent fishing mortality from the deterministic projections consistently indicated the stock to be below the LRP and to be exploited at levels in excess of F_{MSY} . The paper concludes that the 2014 bigeye tuna stock assessment model is not subject to significant retrospective bias and that short-term deterministic catch based projections, conducted from the 2014 bigeye tuna reference case assessment model, provide consistent and relatively accurate indications of stock status in the short-term.

214. Japan asked why the retrospective analysis in the presentation and a similar analysis in 2014 (SC10-SA-WP-01, Figure 10.1) were different, observing that there appeared to be a stronger retrospective effect in the past. Turning to the Majuro plot in the paper, Japan observed SPC's conclusion that the retrospective variation estimates of stock status in the terminal year was not that significant but noted most of the hindcast points are below the reference case assessment result, and asked the implications of this. Because MULTIFAN-CL has to start its projections from a point of estimation, this CCM asked whether the estimates of probability would be influenced by a modification to start from the stochastic estimate for the terminal year, especially when considering the risk of falling below the LRP. Japan also asked SPC if they could change the colour of the lines year by year in the plot for future reports.

215. SPC explained that when they ran the analysis they hoped to run them all through to a similar convergence level, noting that MULTIFAN-CL can be run either for a specified number of iterations or to

the point at which the convergence runs to a specific value. SPC explained that it was not clear at the time they were running the analysis what level of convergence had been used for the retrospective analyses conducted as part of 2014 assessment. Consequently it was difficult to repeat that analysis precisely. On the second question, SPC noted that integrated assessment methods such as MULTIFAN-CL can exhibit different behaviour to Virtual Population Analysis (VPA) type assessment methods in the face of conditions that can generate retrospective bias. For integrated assessments, variability in the estimates of the total population scaling parameter, for example, may shift biomass estimates throughout the whole time series not just for the most recent period. Regarding the deterministic projection results in the Majuro plot, although there was some variability in the distribution of the points, there was no persistent pessimistic trend in the direction of successive points; it is not a progressive increase and extent of negative bias with additional years.

216. In response to questions relating to most points being more pessimistic than the base case model, SPC noted that the points are all more pessimistic but they are not all sequentially pessimistic with successive years; there was not a progressive increase in the extent of the negative bias.

217. USA asked whether the estimates can be adjusted, given the Mohn's Rho value, to reduce bias, as suggested in the study by Deroba (2014), and whether an attempt was made to compare results with projections for bigeye tuna with or without Rho-adjustment in the terminal year.

218. SPC noted that a VPA analysis had not been done; to do so would have required a significant undertaking to combine all the data in a single catch matrix. In terms of correcting the terminal biomass for the retrospective bias, SPC confirmed that it had done that, and that the estimate remained within the approximate 90% confidence interval. SPC had concluded that there was no significant retrospective bias in the assessment, but noted that the debate was ongoing about whether to correct bias estimates and that research was ongoing to understand what causes a retrospective pattern in the first place.

219. USA observed that there are multiple potential causes for a retrospective pattern, one of which is unreported catch, and noted a study of flounder stock where a retrospective pattern existed without running a VPA. USA observed that VPA had the same bias, and is used for consistency. It was further noted that over- or under-estimation of abundance as well as errors in life history parameters can make retrospective biases.

220. Australia noted that the bigeye tuna review picked up the issue of tag reporting rates impacting the biomass scaling, especially when the estimated reporting rate is up against the bounds, and wondered whether SPC had looked at the bounding issue and tag reporting rates.

221. SPC responded that it would be useful to run the retrospective-type approach for specific data components of the assessment as it would begin to reveal which part of the stock assessment input data is drawing in some of the patterns seen.

222. In response to a query from Chinese Taipei about Figure 1, why they were different and whether further examination of the data or the model was required, SPC observed that the difference arises through the estimation process. The general conclusion is that the assessment is not subject to a substantial retrospective bias and the projected stock status is consistent with advice SC has given the managers.

223. FFA members found the retrospective forecasting useful in testing the WCPO assessments and providing confidence in the projection outputs. These CCMs encouraged the continued use of retrospective analyses and noted the potential use of deterministic projections to develop management advice or review the performance of management measures for the key tuna species between stock

assessments, with a caution about the weighting of such advice outside of assessment years. These CCMs noted the further analyses required to understand the relationships between the different factors influencing bigeye CPUE, particularly in the central and eastern area of the WCPO, and looked forward to an update on that work.

4.1.1.2 Provision of scientific information

224. After the theme co-convenor ran through draft stock status and trends and management advice and implications, some discussions took place to shape that text.

225. Some CCMs noted that while there were reported catch reductions in both longline and purse-seine fleets, the information provided indicated no real change in stock status since the 2014 assessment so the SC10 advice should be maintained – that the stock is overfished and overfishing is occurring. These CCMs noted that the deterministic projections may have the potential to be used to provide short term advice on the status of the stock, or to assess the performance of management measures.

226. One CCM noted that the evaluation which had been conducted on the current measure was influential and the projection showed what will happen in 2032 under certain hypotheses. Noting that the projection expects current good recruitment for the next 15 years. Some CCMs expressed concern about whether providing only the good recruitment scenario was sufficient and SPC should add sensitivity analysis for projection under the historical average recruitment when presenting the evaluation of CMM2014-01 to WCPFC13 and in future assessments of bigeye.

227. One CCM noted that according to Figure 9 in the indicators paper, recruitment in 2015 might be substantially less than in recent years.

228. Some CCMs noted that efforts to reduce fishing mortality to increase spawning stock biomass levels above the LRP needed to improve as the stock status was not improving, and noted the work underway to understand the relationships between different factors affecting bigeye CPUE, particularly spatial, temporal, environmental and fleet-specific characteristics. These CCMs recommended that analyses on the economic conditions of the WCPO fisheries should be included in the advice to the Commission, especially the forecast reductions in bigeye CPUE and overall poor outlook for the tropical and southern longline fisheries.

229. SPC noted that SC6 had decided that the best way to do these stock projections was to assume recent average recruitment, and requested clear direction on how SC wanted future projections to be undertaken.

230. In light of next year's yellowfin tuna and bigeye tuna assessments USA recalled the agreement with five CCMs to provide operational level data and historical data. This expired at the end of SC11 so data are quarantined. USA suggested that SPC meet with those five CCMs to discuss a second agreement.

231. CCMs discussed capturing and forwarding to the Commission the key trends in the fishery, including catch and effort, (noting the provisional nature of the 2015 numbers). Whether bigeye tuna effort should be restricted to the tropical area was discussed, along with whether spatial analyses should be included one more tool in the toolbox to inform fisheries managers, or if it could be discussed in the budget and work plan committee without having first been a recommendation.

Stock status and trends

232. SC12 noted that no stock assessment was conducted for WCPO bigeye tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

233. SC12 noted that the total bigeye catch in 2015 was 134,084 mt, which was a 16% decrease over 2014 and a 13% decrease over the average for 2010-14.

234. Purse seine bigeye catch in 2015 was 26% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 13% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower.

235. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013-2015 and which assumed that recent above-average recruitments continued, indicated that the median spawning biomass depletion (SB/SBF=0) of bigeye has been relatively stable since the 2012 assessment.

236. SC12 also noted the importance of retrospective analyses as a diagnostic tool for WCPFC stock assessments. Further, retrospective forecasting of the 2014 WCPO bigeye tuna stock assessment found that the 2014 bigeye tuna stock assessment model is not subject to substantial retrospective bias.

237. In addition, SC12 noted that short-term projections conducted using the results of the 2014 bigeye tuna reference case assessment model provide consistent and relatively accurate indications of stock status in the short term.

238. SC12 notes that the projected median spawning biomass depletion of bigeye in 2016 was $SB_{2015}/SBF=0 = 0.17$. It was also noted that short-term stochastic projections using only the reference case model are likely to underestimate uncertainty in projected stock status.

Management advice and implications

239. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.1.2 WCPO yellowfin tuna (*Thunnus albacares*)

4.1.2.1 Review of research and information

- a. Update of WCPO yellowfin stock assessment

240. G. Pilling presented SC12-SA-WP-03, Purse seine CPUE for skipjack and yellowfin in the PNG purse seine fishery. The decline in skipjack pole and line activity in recent years means that the continuity of this key catch per unit effort (CPUE) time series for the skipjack stock assessment is becoming uncertain. For yellowfin tuna, there are also limitations in the longline data for particular assessment model regions. The designation of a new region in both the skipjack (S5) and yellowfin (Y8) stock assessments also highlights the need for a standardised CPUE time series in that region. Domestic purse seine vessels have operated within Papua New Guinea archipelagic waters for many years, focusing on skipjack and yellowfin tuna. The fishing pattern of those vessels has remained relatively consistent over time, concentrating on sets associated with anchored Fish Aggregation Devices (FADs) and other floating

objects. It was therefore felt feasible to develop a standardised CPUE series for the two species in this region, using a delta-lognormal approach for the period 1997-2012. Resulting standardized skipjack CPUE for the period showed a general decreasing trend over time. The model indicated that the primary driver of that decline was reductions in the probability of a successful set. Resulting yellowfin standardized CPUE for the period showed a slight decline over time, attributed by the model to reductions in the probability of a successful set. The CPUE was much more variable over time when compared to skipjack. We note that there are uncertainties in the use of purse seine CPUE as an index of abundance, given that the schooling of fish, particularly under FADs. We also note that while the fishing method has been relatively 'constant' over time, there have been an increase in the number of sets per day (one associated and one unassociated set on the same day becoming slightly more common) and a shift towards unassociated sets for some vessels (the model being developed on associated-set data only to minimize the impacts of these changes), and changes in the number of anchored FADs deployed over time (although there was no clear signal found in the standardized series that related to those trends).

241. Australia reiterated that if SC was going to continue using indicator papers, more information was required. It was noted that the CPUE trends plot for the longline fleet showed the Japan fleet up 200% and the Korea fleet down 75%, which was contradictory; since the fleets must have fished in completely different areas, the indicators are for different regions. This CCM suggested it would be useful for a map to be included showing where each of the fleets fished to help SC interpret the numbers.

242. SPC confirmed that spatial patterns of the longline fleets could be included in future analysis. It was noted that 2015 data was provisional and would be updated by the next round of data submissions, so substantial reviews can be expected across most fleets for 2015.

243. Korea noted that the CPUE of Korea longline fishery for 2014 showed an increase compared to 2013 and asked SPC to check again the CPUE data.

244. SPC noted that the data presented in the plot came from the region 20°N to 10°S specifically, and agreed to check the CPUE data trend for the Korea longline fishery.

245. FFA members stated that SC should continue to support indicator work in non-stock assessment years as well as annual updates of this work for all key species in non-stock assessment years.

4.1.2.2 Provision of scientific information

Stock status and trends

246. SC12 noted that no stock assessment was conducted for WCPO yellowfin tuna in 2016. Therefore, the stock status description from SC10 is still current. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

247. SC12 noted that the total yellowfin catch in 2015 was 605,963 mt, a 2% increase over 2014 and a 7% increase over the average for 2010-14.

248. Purse seine yellowfin catch in 2015 was 15% lower than that in 2014 and effort was 21% lower. Longline catch in 2015 was 2% lower than that in 2014, and tropical longline effort (20N-10S) was 4% lower. Catches of other gears increased by 47% from 2014 to 2015.

249. SC12 noted that the results of the updated short-term projections using actual catch and effort levels in 2013-2015 indicated that the projected median spawning biomass depletion

(SB/SBF=0) of yellowfin showed an increasing trend since 2012. SC12 also noted that the projected median spawning biomass depletion of yellowfin in 2016 was SB2015/SBF=0 = 0.49.

Management advice and implications

250. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.1.3 WCPO skipjack tuna (*Katsuwonus pelamis*)

4.1.3.1 Review of research and information

- a. Review of 2016 skipjack tuna stock assessment

Skipjack catch per unit effort

251. H. Kiyofuji presented SC12-SA-WP-05, on skipjack catch per unit effort (CPUE) in the WCPO from the Japanese pole-and-line fisheries. Catch per unit effort (CPUE) of skipjack caught by Japanese pole and line (JPN PL) in two spatial structures (same as 2014 stock assessment and alternative spatial structure for 2016 stock assessment as sensitivity runs) were estimated from logbook data between 1972 and 2015. Three years' data from 2013 and 2015 were added after the 2014 stock assessment and model configuration for estimating CPUE were same as in 2014. Standardized CPUEs for alternative spatial area definition in 2016 were also estimated by two cases using all available data and extracted data that vessel operated continuously for more than 30 years. Overall trend of standardized CPUEs by updated data in each area were similar results by 2014. As for alternative spatial structure, overall trends by core data decreased in each region. Standardized CPUEs by all data were lower than results the CPUE by core data before 1990 especially in area 2 (tropical) and area 6 (subtropical). This indicates that vessels operated before 1990 have some impacts for estimating CPUE. Estimating CPUE by the JPNPL by core data should be used in the assessment because clearer data have exceptional prospects for stock assessment inputs.

252. Australia noted the decline in recent years in the CPUE index in region 3 (based on using the 2014 spatial structure) and, noting the decline in the spatial extent of the pole-and-line fishery in this region as shown in Figure 3, asked whether the change in CPUE may be related to the decrease in the area being fished. Additionally, this CCM asked why a subset of core vessels had not been used for constructing the CPUE index using the 2014 spatial structure.

253. H. Kiyofuji responded that Japanese fisheries have contracted and one way to resolve that is to use one index for the tropical area. Regarding core vessels, H. Kiyofuji would like to do that in the future assessment.

254. USA noted the paper's influence in the skipjack tuna assessment. This CCM noted incongruity between the idea of range contraction and reduced availability of catch to the small scale fleets around Japan, noting that Area 7 corresponded to some of the areas optimistic since 2005.

255. H. Kiyofuji noted that because of the boundary between Areas 1 and 7; if the boundary of Area 1 is changed WCPFC would average; Area 1 would go up and Area 7 would go down. There was a need to look at this boundary.

256. Japan commented that the biggest impact is now felt by the trolling vessels operating in a much more limited coastal area.

257. In response to a comment from Indonesia that an increase in purse-seine vessel fishing in the same area might impact the CPUE of pole and line, H. Kiyofuji confirmed that the pole and line CPUE would be affected by other fisheries. On the question of including this in the CPUE, H. Kiyofuji considered that it might be improved but it would be difficult to include other fisheries catch in the model.

258. SPC commented that it would not be advisable to include other fisheries catches in this analysis; they should not be standardised out but put into the assessment model. SC should not confuse range contraction with direct interaction impacts by fisheries; range contraction results from density dependent changes in fish movement from the core area, making fish less likely to move to more distant areas as the stock in the core area is reduced. SPC noted that CPUE in the coastal area showed a sharp upward swing and wondered how this was compatible with range contraction.

259. H. Kiyofuji commented that the CPUE trend was derived from the offshore pole and line fishery and considered that the area boundary between Areas 1 and 7 had impacts on the standardization process. If Areas 1 and 7 were combined as a Northern area it would be more stable or relatively lower.

260. EU wondered whether the authors had explored including environmental variables in the evaluation.

261. H. Kiyofuji confirmed that oceanographic factors were not included in the standardisation process; it was difficult to know what kind of environmental factors should be included but it was unclear how they impacted CPUE. Some thinking around what kind of factors should be included in this process would be useful. H. Kiyofuji commented that when standardized, some index of the Kuroshio could be made, but Kuroshio has not changed a lot in 40-50 years.

262. USA noted relative stability in Area 1 but Area 7 saw a 50-100% increase in standardised CPUE in the past 10 years. Commenting that range contraction should cause reduced availability to the entire Japanese archipelago, this CCM commented that an alternative hypothesis for range contraction would be that of localised depletion, where removals from the Japanese offshore pole and line fishery reduced catches for the smaller coastal troll fleet. This CCM asked how much catch was removed by the pole and line fleet.

263. H. Kiyofuji noted that the coastal troll fishery targeted skipjack tuna only in springtime, fishing for smaller fish coming from the south. H. Kiyofuji considered this would not have much impact, considering the local depletion hypothesis not possible.

264. Australia suggested that the CPUE index within Region 1 based on the 2014 spatial structure had been slightly above the long term average which did not seem to support the hypothesis that there had been any spatial contraction of the skipjack resource within this region. Noting that trips had not been included in the analysis where there was less than 25% skipjack tuna in the total catch, this CCM asked whether there might be selective bias during a trip depending on whether there may be a market preference to target albacore over skipjack during the trips analysed and whether this preference may have changed over time.

265. H. Kiyofuji commented that the schools did not mix and the fishers caught schools as they find them.

Stock assessment

266. S. McKechnie (SPC) presented SC12-SA-WP-04, a stock assessment of skipjack tuna in the western and central Pacific Ocean. An updated stock assessment of skipjack tuna in the western and central Pacific Ocean was conducted in 2016 with data up to the end of 2015 used (3 years of extra data since the 2014 assessment). New developments to the stock assessment include addressing the recommendations of the 2014 stock assessment report, exploration of uncertainties in the assessment model, particularly in response to the inclusion of additional years of data, and to improve diagnostic weaknesses of previous assessments. The main conclusions of the current assessment are largely consistent with previous assessments and are based on the results of the reference case model and consideration of the results of one-off sensitivity models and the structural uncertainty grid. Stock status is estimated to be similar to the 2014 assessment, though with several years of moderately higher biomass since, catches are lower but approaching MSY, fishing mortality has increased significantly since early in the assessment period, recent estimates of spawning biomass are well above the LRP and accepted depletion-based reference points are close to the adopted interim TRP for all models investigated. Several recommendations were made to further improve and allow ongoing stock assessments including investigation of alternatives to pole-and-line CPUE indices and continuation of tagging programmes.

267. A lengthy discussion took place between Japan and SPC, with Japan sharing its concerns that the assessment of skipjack stock status seemed optimistic compared to the 2014 previous assessment, and did not match the low abundance trend in Japanese coastal fisheries and low skipjack catch. As well as in its coastal waters, Japan cited anecdotal information from offshore fisheries targeting skipjack around Japan that fish schools were smaller relative to 10 or 20 years ago, and even finding those fish schools was difficult despite modern fish-finding technology. Consequently there was a strong interest in the new stock assessment. The assessment conclusion emphasised consistency with the biomass trend from the previous assessment, but this CCM observed that previous assessments are not always correct. This CCM's main concern related to scientific and technical matters in the following areas: (1) growth function because model estimates was faster than that based on otolith data, (2) different area definition to present more plausible skipjack movement in the WCPO and to improve estimates of movement rate among areas, (3) impact of weighting of tagging data, sensitivity of reporting rate, likelihood profile by parameters and (4) natural mortality because no biological and ecological explanations were made. This CCM also pointed out that overall model diagnostics are lacking and necessary to evaluate full range of likelihood for all data to check robustness of the base case model. There are also some questions regarding importance of tagging data rather than CPUE, appropriateness of recruitment assumption, goodness of model fitting to size data and JPNPL CPUE. Japan stressed the need for additional work to improve growth function, with broad collaborative research required, including with other member countries, and the development of purse-seine CPUE. This CCM also suggested that other different models such as the SEAPODYM and SS3 can be used to check whether model assumptions are likely and robust because these models have been developing with different concept. Japan stated that there was a risk that the confidence of stakeholders in SC's scientific advice could be undermined just as the Commission was moving towards HCR and MSE, where stakeholder buy-in was important; in addition, any questions around the assessment may create difficulties for those seeking market incentives. This CCM stated that the conduct of the stock assessment was not an inclusive process, as CCMs are not involved in the actual work of the assessment itself, just the pre-assessment workshop, and information about the progress of the stock assessments is not provided until the working paper is submitted to the SC meeting. Japan asked that the points raised be addressed by the scientific service provider.

268. In response to these concerns, SPC explained that in its view the assessment was not substantially more optimistic than the 2014 assessment. The key stock status indicator was $SB(\text{latest})/SB(F=0)$ with the median value of this ratio from the structural uncertainty grid 0.51 (outlined in Table 8); the equivalent estimate from the 2014 assessment was 0.52. Likewise, the median estimate of F/F_{MSY} from the current assessment was 0.48, while the equivalent estimate from the 2014 assessment was 0.45. The current assessment is slightly more pessimistic than the 2014 assessment in terms of those two key indicators,

although marginal, and was the basis of SPC's conclusion that the overall stock status was consistent with the 2014 assessment. SPC explained that the assessment used pole-and-line CPUE indices provided by Japan, which do not indicate substantially reduced skipjack tuna abundance in Region 1. In the re-stratified CPUE of the alternative spatial structure (presented in SC12-SA-WP-05), the pole-and-line CPUE for region 7 showed a strong increase since 2010. Regarding sensitivity of different area definition, SPC noted that the Japan CPUE indices for the alternative spatial structure were only provided two weeks before the paper was due for submission to WCPFC, which did not allow time to undertake the work. Regarding impact of weighting of tagging data, SPC noted that the weighting of the tagging data is controlled through the over-dispersion parameter, and 2 sensitivities with higher levels of over-dispersion were done. SPC noted there were many reporting rates in the model, and uncertainty in the reporting rates was reflected through the specification of priors. Regarding likelihood profile by parameters, SPC noted that expanding the diagnostics for likelihood profiles is a priority, with the aim of having it well developed for SC13. SPC explained that its approach to investigating relative data weighting of components is to use sensitivity analyses which provides essentially the same information as a likelihood profile, and has the benefit of allowing consideration of a wider range of parameters than the single parameter investigated with typical likelihood profiles. SPC noted that future assessments will combine both approaches. Regarding natural mortality, SPC explained that, because age-class 1 is essentially prior to the commencement of significant exploitation, changing the M for age-class 1 to a higher level would simply scale the recruitment higher, and none of the other estimates would change.

269. FFA members noted the significant improvements since the 2014 stock assessment and endorsed the reference case selected, recognising the value of modelling a range of uncertainties. These CCMs encouraged investigation of alternative indices of abundance that take into account any effort creep in the purse-seine fishery, and supported the recommendation for a tagging program to improve skipjack recapture data to be integrated as a measure of abundance in a future assessment, which the MSE expert workshop recommended (SC12-MI-WP-05), in way which did not place a further burden on SIDS governments. These CCMs urged the continued evaluation and implementation of e-reporting initiatives where practical and cost-effective to enable stock assessments to be undertaken with the best data possible.

270. EU commented that the assessment has been improved this year compared to 2014. It noted that in 2014 Japan did not find major problems with the stock assessment and no delegation had questioned the conclusions.

271. Australia supported the sentiments expressed by the EU, and stated that having a range of questions asked in spirit of continual improvement should not be confused with a lack of confidence in the overall assessment conclusions. Australia observed that only one CCM had commented that they lacked confidence in the assessment. Further, the power of an integrated assessment was to take a wide range of data sources and apply a modelling technique to estimate quantities of management interest. The presence of individual indicators or anecdotal evidence that goes against assessment conclusions is an insufficient basis for setting aside an assessment. Australia gave its categorical support for the 2016 skipjack tuna assessment as a basis for formulating management advice.

272. USA noted the structural improvements in assessment this year, and the continued improvement of MULTIFAN-CL. This CCM stressed the total quality improvement through time. This CCM's comments did not impugn the base case as not being the best current available information but USA had four concerns with the base case assessment model. First, the CCM reiterates the concern expressed by Japan about the biological realism of estimated natural mortality rates in the model. In particular, Figure 12 in the stock assessment document shows that age-1 fish are estimated to have a lower natural mortality rate than age-2 fish, where age is measured in quarters. This is totally unexpected in ecological theory, because natural mortality rate are expected to scale with body mass, as well as temperature. In particular,

younger fish generally experience higher natural mortality rate than larger, older fish, see for example the MacArthur Award paper by Brown et al. (2004. Toward a metabolic theory of ecology. *Ecology* 85:1771-1789). This concern also pertained to the unusual pattern in the estimates of natural mortality rates of older age classes which increase for ages 6 to 10 quarters and then unexpectedly decrease for ages greater than 10 quarters. The increase in natural mortality from ages 6 to 10 can be explained as senescence but the subsequent decrease for fish older than 10 quarters does not have a clear biological explanation. This CCM suggested that it would be more parsimonious and biologically accurate to estimate a single natural mortality rate parameter for ages older than 10 quarters and similarly, to set the natural mortality rate for age-1 quarter fish to be equal to the estimated age-3 quarter natural mortality rate parameter, or use an expected Lorenzen-type allometric scaling of natural mortality rate to body mass (Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. *Journal of Fish Biology* 49:627-647) to develop prior distributions for the younger age classes with ages less than 6 quarters based on their expected mean weight at age. This CCM expressed interest in seeing an alternative assessment model run in which a single natural mortality parameter was estimated for ages 1 and 2 quarters and a single natural mortality rate parameter was estimated for fish of age 10 and older, noting that the estimates of age-1 and age-10+ natural mortality appear to be an artifact of the parameter estimation process. Secondly, there was a concern about the impacts of estimating the standard deviations of growth parameters because of their substantial effects on the scaling of spawning biomass (see Figure 47 in SC12-SA-WP-04). This CCM also asked that the rationale for the assumed values of the standard deviations of growth parameters in the base case model. Thirdly, this CCM expressed concerns about the potential for temporal variation in life history parameters, such as maturity and growth rates, which may be expected to change as the skipjack population density has changed through time, noting that with a small bodied, fast growing tuna some density-dependence in vital rates may be expected. Fourthly, this CCM noted that the assumed stock-recruitment steepness in the base case model was expected to be inversely related to the estimated natural mortality rates. As a result, it was highly unlikely that skipjack, which have higher natural mortality rates at age than the larger-bodied bigeye tuna species would share the same stock-recruitment steepness parameter value of $h=0.8$ as assumed in the base case assessment models for both stocks (e.g. Mangel et al, 2010, Reproductive ecology and scientific inference of steepness: a fundamental metric of population dynamics and strategic fisheries management. *Fish and Fisheries* 11:89-104)). This CCM emphasized the importance of ongoing collection of empirical data to characterize time variation in the life history parameters of skipjack and other tropical tuna species to improving the biological information for stock assessments.

273. SPC made a number of comments in response: Regarding natural mortality, there is a trade off because it is unobserved and changes other parameters. Fixing 1 and 2 may not currently be achievable in MULTIFAN-CL. SPC noted that you can fix the whole growth rate but it will affect other parameters which depend on age classes. SPC noted that this was the only stock assessment SPC conducts which estimates natural mortality; they could penalise the difference more between the two age classes. Regarding standard deviation on growth, SPC noted that this came from a previous estimate. Regarding maturity, SPC explained that this was based on some empirical work undertaken some years ago. It was noted that a number of parameters are assumed to be density-dependent, and MULTIFAN-CL may not allow for this density parameter. SPC explained that the steepness values it uses are decided in the pre-assessment workshops; the next workshop could develop an approach for how to look at the sensitivities.

274. China commented that technological improvements over time, including increased net sinking rate, winch power, and the gradual replacement of radio buoys with echo sounder buoys, were crucial to understanding the CPUE standardisation process, and suggested investigating variations in fishing power for the main purse-seine fleet to better understand CPUE trends.

275. EU noted that the estimates of population and fishing mortality seemed consistent, with increasing MSY across the years, and asked whether trends in recruitment were linked to constraints in population. EU agreed that the weighting of the tagging data appeared to be one of the most influential factors and, since tagging data can be constraining the total population estimates and may be behind the increased trend in the estimates of MSY in the successive assessments, wondered if retrospective forecasting might be helpful in establishing more plausible weightings for the different data inputs. Taking into account the short life-span of skipjack in relation to other species, EU asked if the CPUE could be more prone to a systematic bias, perhaps due to effort creep, since it is more difficult to track age classes through time.

276. SPC commented that this year the main increase has been due to the move to the annual SRR. Referring to the Table of reference cases of sensitivities in the paper, MSY and MSY SRR were 1.59 million tonnes compared with 1.53 million tonnes in 2014. SPC noted that in previous assessments there has been an increase in MSY; this may be an increase in one way trip-type fishing scenarios and the model has to increase recruitment slightly. SPC confirmed that conducting retrospective analyses to see if the different models result in better forecasting in the reference case had not been considered in detail but was feasible, with computing time the constraint. The model takes about 8 hours for each sensitivity.

277. Chinese Taipei asked about the effect the 2012 change in reporting practice regarding transit days large purse-seine vessels had made, noting the change began in 2012 and may have caused the appearance of a 25% reduction of fishing effort and the same time as the stock assessment model predicts an increase in CPUE. Chinese Taipei asked if this was attributable to the changed reporting practices and whether this changed practice had been incorporated into the model. This CCM made a comment that the movement of skipjack tuna is a high variable, and the spatial structure of this species has changed in each of the last three stock assessments. Chinese Taipei expressed interest in seeing a new sensitivity around the new spatial structure in the future.

278. SPC suggested that it does not have a large effect as the penalties on these fisheries in the model are low, i.e. the relationship between fishing mortality and effort for purse-seine fisheries is not overly influential in the model. Regarding spatial structure, SPC noted that the intention has been to keep working with Japan's H. Kiyofuji and others to investigate the sensitivity of the model to these types of issues.

279. PNA members accepted the stock assessment and supported the conclusions and recommendations, especially that regular large-scale tagging cruises and complementary tag recovery work should continue, in a way that provides the best possible data for stock assessment purposes. They shared the view of others that while the assessment showed that the stock was healthy, the measures controlling fishing for skipjack should continue to tighten, with a focus on harvest control rules (HCRs).

280. Australia asked if it remained useful to continue with MSY-based reference points. Noting that catch in Region 3 went up quite dramatically and catch in adjacent regions went down, Australia asked if this was movement-related, or if productivity was better. Noting some discrepancies in the data, Australia asked if the utility of the CPUE index was decreasing, and whether SPC had further considered alternative indices for movement.

281. McKechnie responded that getting movement and recruitment correct was important. Information in the SEAPODYM model could help MULTIFAN-CL model movements of fish; the question may have to move to another platform as the movement may not be able to be fixed at set values.

282. J. Hampton (SPC) suggested that it is possible to use SEAPODYM estimates of movement coefficients as fixed parameters in MFCL and this has been tried in the past.

283. McKechnie commented that estimating time-variable movement would make for an unstable model, and noted that there was some discussion at the MSE workshop about how this might be achieved. Alternative indices might be found within the purse-seine fishery, with core vessels or fleets.

284. PNA members noted their interpretation of the estimates of fishing mortality and the yield curve in Figure 41 was that it would take a doubling of effort to harvest the MSY, with only a 15% increase in catch. If this was correct it suggested that the TRP was in about the right place in terms of the fishery's economics. These CCMs noted the advice in the assessment about the need for an ongoing tagging programme and looked forward to a proposal for this. They asked how the amount of tagging needed was determined.

285. SPC commented that tagging data was highly influential. The amount of tagging data per tagging event, the number of tagging events and where those tagging events took place were all important factors. It should be possible to evaluate alternative tagging designs in the MSE framework, or using a dedicated tag data simulator.

286. PNA members asked what the systematic flattening of the trends in catchability in Figure 28 indicated, and whether something in the model or data signalled this shift in the trend, noting that it also occurred in the yellowfin tuna assessment. PNA members wondered if the decreasing recruitment estimates for the latest periods in the model shown in Figure 31 were concerning.

287. J. Hampton (SPC) noted that the flattening of catchability trends was not uncommon with integrated assessments where the catchability deviations tend to their prior (zero) as the quantity of data for individual cohorts become successively more truncated towards the end of the assessment time period; this could be investigated in a bit more detail with retrospective analysis.

288. SPC explained that it fixes the aggregate recruitment for the last two quarters at the mean because they are hard to estimate (for the same reason as described in the preceding paragraph), and that this gives the appearance of a reduction at the end of the time series. SPC suggested ignoring the past two quarters.

289. Korea noted that the most important things to investigate for skipjack tuna were movement and migration. Korea supported tagging efforts.

290. SPC noted that for skipjack tuna biennial tagging cruises were planned, alternating between bigeye tuna and skipjack tuna. It was noted that tagging was important for this assessment and strategic thought was needed in considering how to support it.

291. The Science Manager advised that USD\$40,000 remained in the budget for Project 67 (Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area) and reminded SC12 that SC11 recommended further work on this, including more extensive skipjack tagging activities and analysis of operational longline data (Paragraph 282, SC11 Summary Report). Japan, SPC and relevant CCMs would further consider the scope of work in the margins of SC12 and prepare terms of reference for SC's consideration.

292. USA asked for information on a TOR for the project during SC12, noting that the \$40,000 could be rolled over to the general fund.

293. The theme co-convenor noted that these discussions would continue during the meeting as SC12 built recommendations.

294. In the margins of the meeting, SPC and Japan talked through the technical details of the stock assessment with a view to increasing understanding of the indices and data used, the analysis and the technical process.

295. Afterwards, Japan stated that, with the information provided in the assessment report and later privately from SPC, it is scientifically not possible to select a base-case from various sensitivity runs because of the lack of likelihood profile and clear explanation for the selection of the value of overdispersion in tagging information in the reference case. In response, SPC stated that all sensitivity runs are equally plausible and SPC does not advocate the reference case to be the base case. Some CCMs, however, supported the reference case to be the base case for the sake of continuity and consistency of scientific advice.

296. Three options for formulating skipjack tuna status were drafted for the recommendation session for skipjack tuna. The first option was to base the skipjack tuna status on the reference case model on the reference case model with the structural uncertainty grid used for considering uncertainty. Two other proposals were drafted; one had no support so it was abandoned. The remaining alternative option was for the stock status of skipjack tuna to be based on all of the uncertainty grids based on the sensitivity runs. It was noted that skipjack tuna was one of the most valuable stocks in the Pacific and SC12 should strive to have one view on the stock. No agreement could be reached on one option. Most CCMs chose option 1, while three CCMs (China, Japan and Chinese-Taipei) chose the alternative option.

297. During discussions it was noted that a statement could be included relating to progressing with improvements to the base case and that uncertainties exist in any model of such a dynamic and complex species. It was noted that this was the first time a minority and majority view had been formulated for a WCPFC stock assessment, so there was a need to be careful regarding the advice SC12 would provide. It was noted that in other tuna RFMOs, skipjack tuna was not typically assessed with an integrated stock assessment model because it was a complex and dynamic resource. Some CCMs noted that the assessment was based on more data than any other WCPFC stock assessment presented and work was of a high level.

298. It was noted that within the single base case model, there was uncertainty regarding the derived parameter MSY, and the grid contained a variety of estimates of MSY. Some CCMs noted that SC12 needed to be cognisant that a separate discussion was taking place regarding TRPs, LRP and HCRs.

299. In order to provide the best available scientific advice to WCPFC, some CCMs requested the scientific services provider to develop an alternative stock assessment analysis (i) to conduct an alternative assessment based on the area definition suggested by Kiyofuji et al. (SA-IP-09) and (ii) to prepare likelihood profile analysis for both the current and the alternative assessment configurations to SC13. Some CCMs further requested the scientific services provider for the next full stock assessment to (i) evaluate the results of multiple models such as SEAPODYM or Stock Synthesis, (ii) test different growth models such as those suggested by Ochi et al, (iii) test alternative natural mortalities such as constant one or one that decreases as aging, and (iv) evaluate appropriate method to weigh tag information. In doing so, these CCMs requested the scientific services provider to further promote the inclusiveness of the assessment process of member country scientists by allowing greater participation and frequent information sharing in the course of the development of assessment, which will increase transparency of the organization. However it was noted that most CCMs did not think it was necessary and the scientific services provider only has the capacity to do three assessments per year. It was proposed by one CCM that national scientists be given a greater role in the assessments to improve the robustness and transparency. One CCM doubted any other RFMO had such a transparent process. The issue of range contraction was discussed but despite the divergent views it was noted that it had not been demonstrated or disproved.

300. PNA Members expressed their opposition to the proposal for fishing states scientists to be given a greater role in assessments like in other RFMOs. They noted that, unlike other RFMOs, the major stocks in the WCPO occur largely in the waters of developing countries, especially SIDS who have property rights over those resources. This needed to be reflected in the WCPFC processes and the current scientific process does this by reflecting a balance of considerations relating to participation, independence, transparency and cost effectiveness in accordance with the WCPFC Convention.

4.1.3.2 Provision of scientific information

Stock status and trends

301. S. McKechnie presented SC12-SA-WP-04 (stock assessment of skipjack tuna in the western and central Pacific Ocean) that assessed the stock of skipjack tuna in the WCPO up to the end of 2015. New developments to the assessment include addressing the recommendations of the previous assessment (2014), exploration of uncertainties in the assessment model, particularly in response to the inclusion of additional years of data, and to improve diagnostic weakness of previous assessments. Other key papers were presented to document: 1) methods of estimating standardized catch per unit effort indices, 2) construction of the tagging data input file, 3) revisions and summaries of fisheries definitions, and the guidance of the Pre-assessment workshop.

302. SC12 noted that the skipjack catch in 2015 was 1,827,750 mt, was a 9% decrease over 2014 and a 3% increase over the average for 2010-14.

303. Purse seine skipjack catch in 2015 was 13% lower than that in 2014 and effort 21% lower.

304. The SC12 was unable to reach consensus on the description of stock status based on the 2016 stock assessment.

305. SC12 notes that the majority of member countries agreed on the following description of WCPO skipjack tuna status and trends.

Majority view of stock status and trends

306. **A majority of SC12 CCMs selected the reference case model as the base case to represent the stock status of skipjack tuna (column “Ref Case” in Table SKJ2). To characterize uncertainty, those CCMs chose the structural uncertainty grid. Summaries of important model quantities for these models are shown in Table SKJ2.**

Table SKJ1. Description of the structural sensitivity grid used to characterise uncertainty in the assessment. The reference case option is denoted in **bold face**.

Axis	Levels	Option
Steepness	3	0.65, 0.80 , or 0.95
Mixing period	2	1 quarter mixing , 2 quarters mixing
Length composition weighting	3	Sample sizes divided by 10, 20 , or 50
Tagging overdispersion	3	Default level , Estimated, or Fixed (moderate) level

Table SKJ2: Estimates of management quantities for the selected stock assessment models. For the purpose of this assessment, “recent” is the average over the period 2011–2014 and “latest” is 2015. The column “Ref Case” shows summaries for the reference case and the remaining columns are the quantiles of the structural uncertainty grid, e.g. 5% and 50% are the 5% quantile and the median (50% quantile), respectively. Option 1 in the text recommends basing management advice on the reference case model and considering the uncertainty represented by the 5% and 95% quantile columns. Option 2 recommends basing management advice on the range of model runs in the structural uncertainty grid, as represented by the 5% and 95% quantile columns.

Quantity	Ref Case	50%	5%	25%	75%	95%
C_{latest}	1,679,528	1,679,444	1,678,646	1,679,170	1,679,497	1,679,592
MSY	1,891,600	1,875,600	1,618,060	1,785,400	1,976,700	2,199,880
$Y_{F_{recent}}$	1,594,800	1,607,000	1,486,660	1,533,200	1,755,200	1,808,860
f_{mult}	2.23	2.07	1.57	1.85	2.29	2.62
F_{MSY}	0.24	0.24	0.21	0.22	0.26	0.28
F_{recent}/F_{MSY}	0.45	0.48	0.38	0.44	0.54	0.64
SB_{MSY}	1,626,000	1,628,000	1,258,700	1,425,750	1,852,750	2,166,100
SB_0	6,764,000	6,359,500	5,214,050	5,853,750	7,095,250	8,340,450
$SB_{F=0}$	7,221,135	6,876,526	5,778,079	6,408,578	7,425,353	8,555,240
SB_{latest}/SB_0	0.62	0.55	0.43	0.49	0.59	0.71
$SB_{latest}/SB_{F=0}$	0.58	0.51	0.39	0.47	0.57	0.67
SB_{latest}/SB_{MSY}	2.56	2.15	1.6	1.81	2.43	3.08
$SB_{recent}/SB_{F=0}$	0.52	0.49	0.4	0.46	0.52	0.57
SB_{recent}/SB_{MSY}	2.31	2.04	1.58	1.82	2.32	2.65

307. Trends in estimated recruitment, spawning biomass, fishing mortality and depletion are shown in Figures SKJ 1-4.

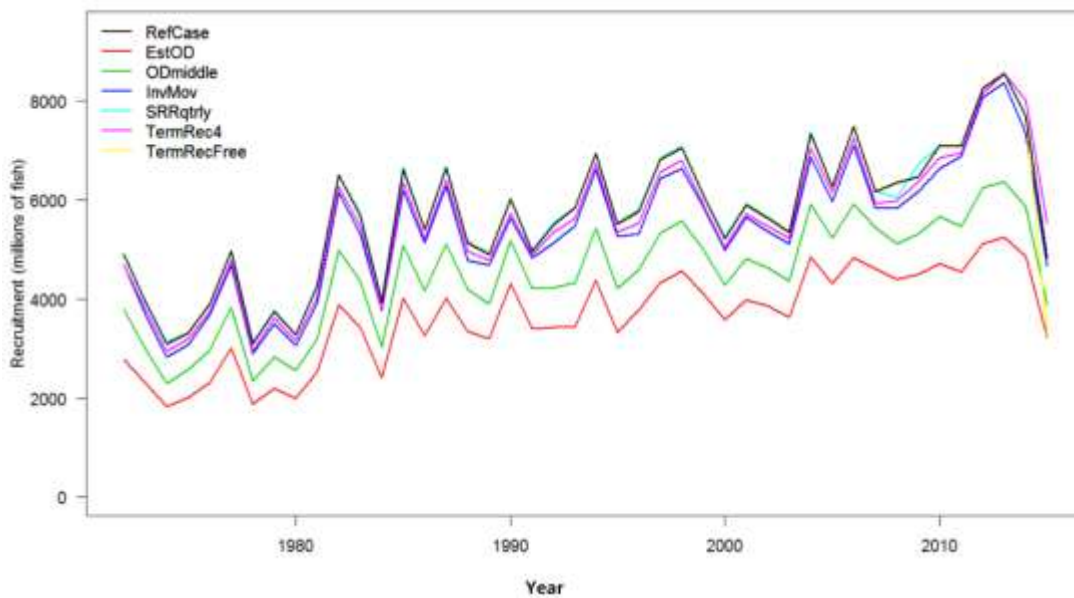


Figure SKJ1: Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference case model and six additional runs.

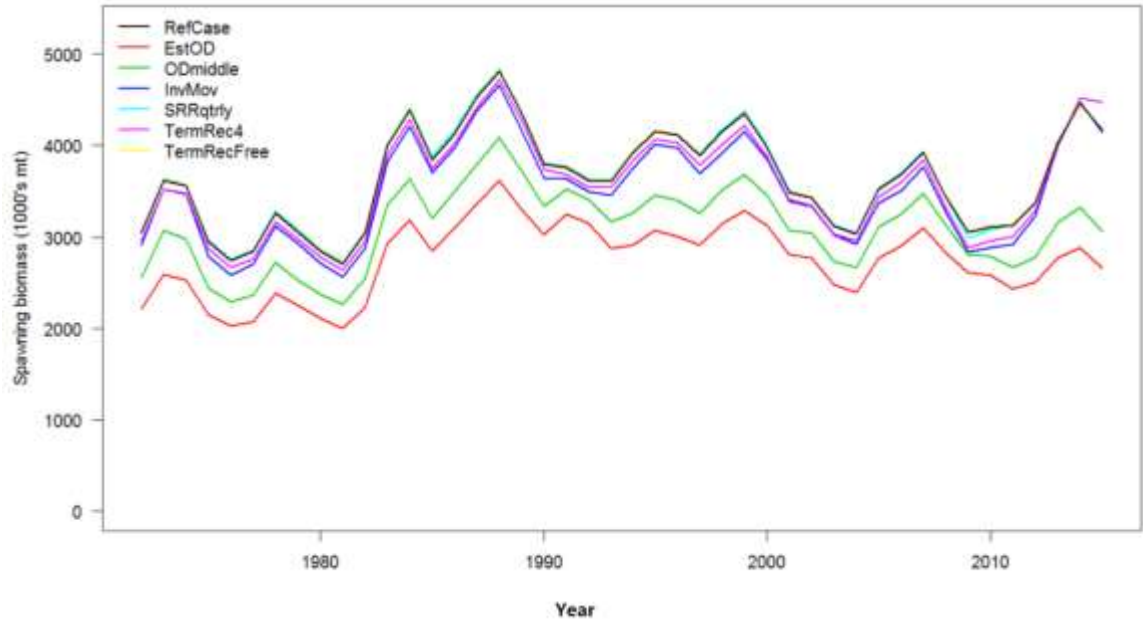


Figure SKJ2: Estimated annual average spawning potential for the WCPO obtained from the reference case model and six additional runs.

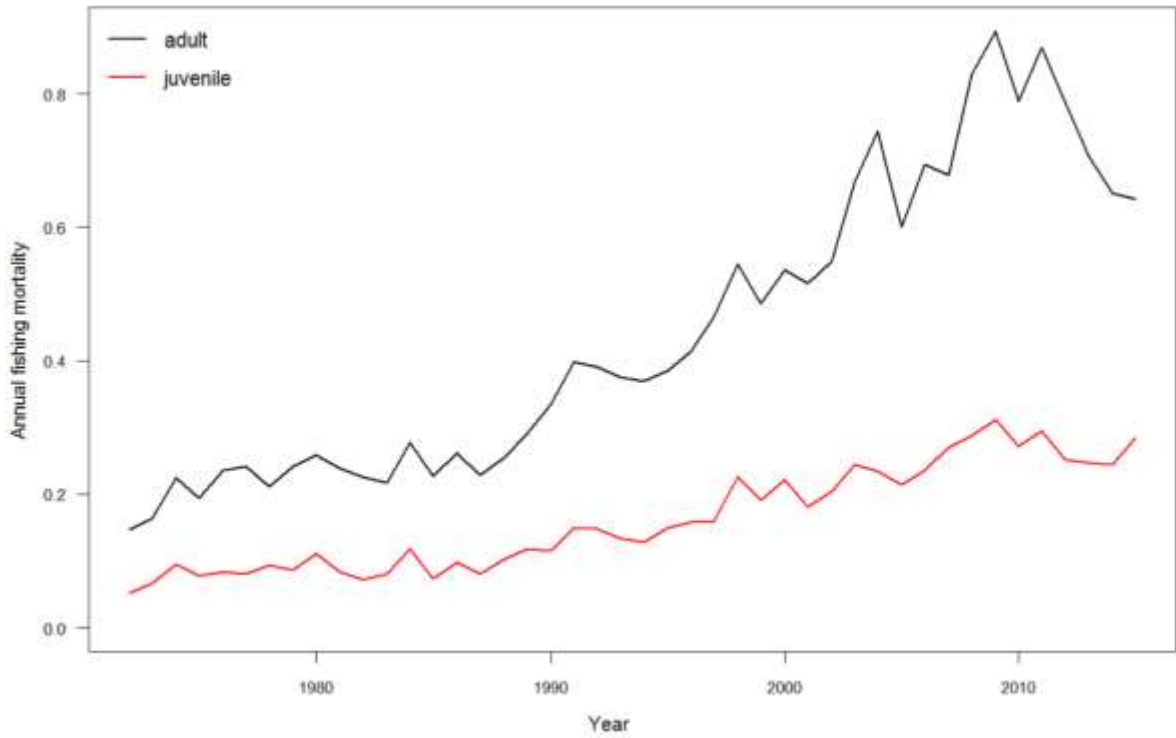


Figure SKJ3: Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model.

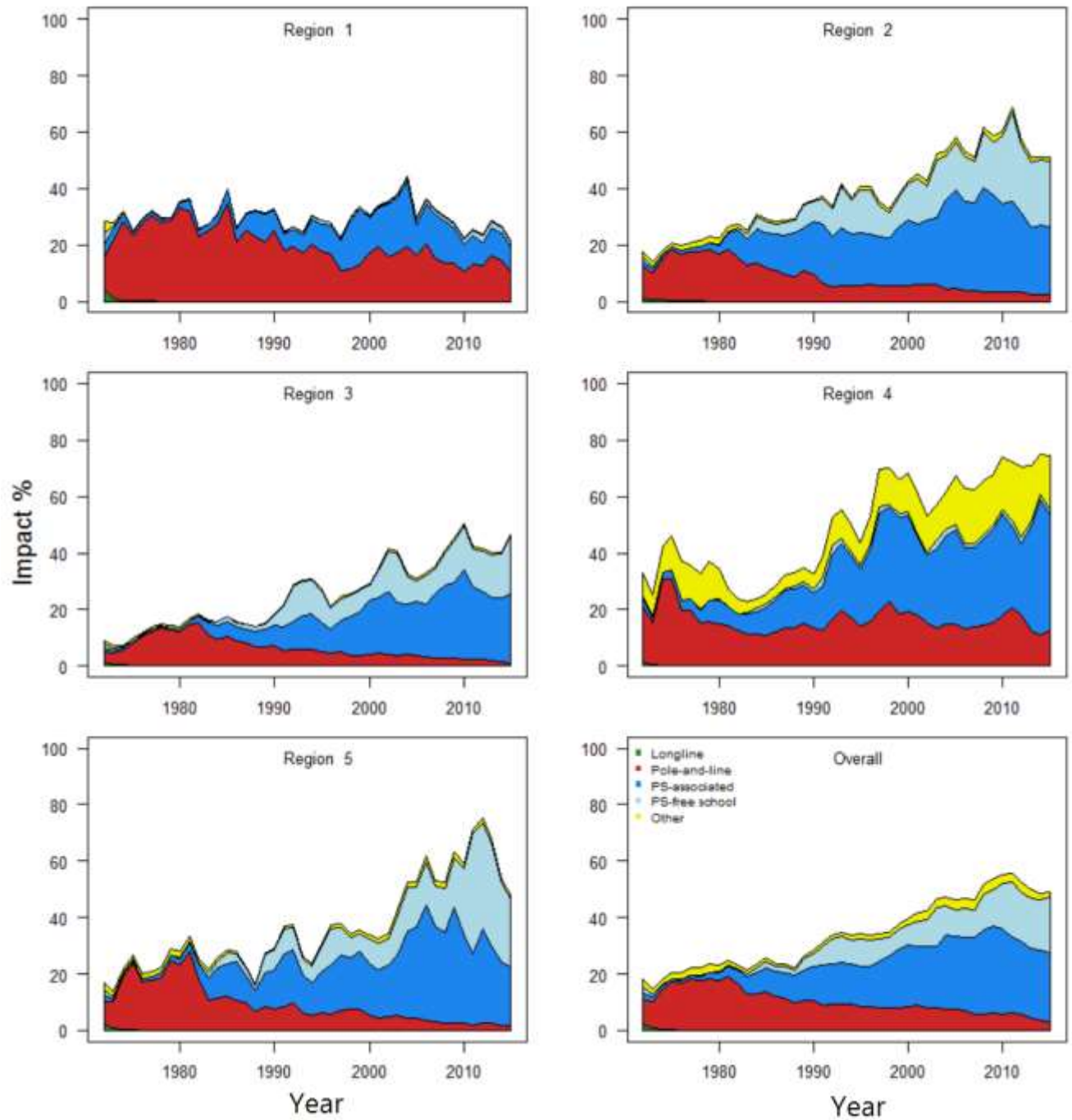


Figure SKJ4: Estimates of reduction in spawning potential due to fishing (fishery impact = $1 - SB_t / SB_{t, F=0}$) by region and for the WCPO attributed to various fishery groups for the reference case model.

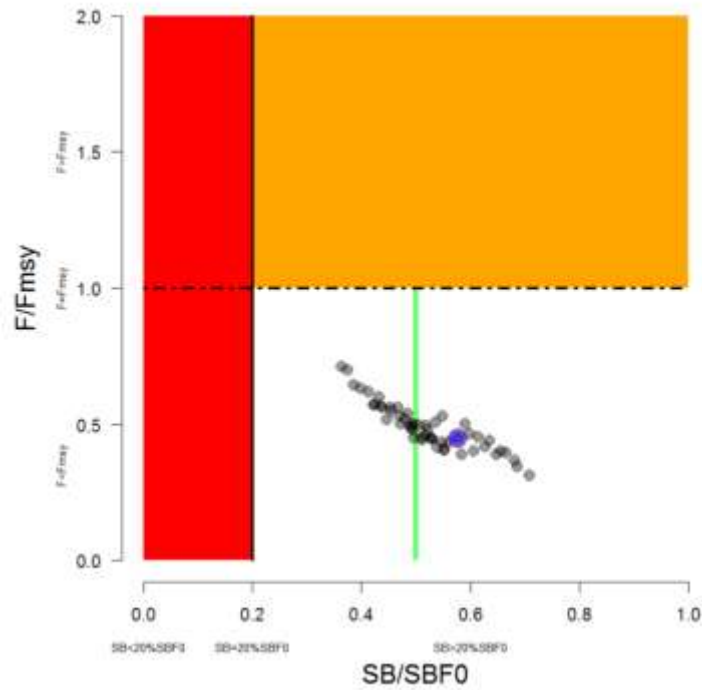
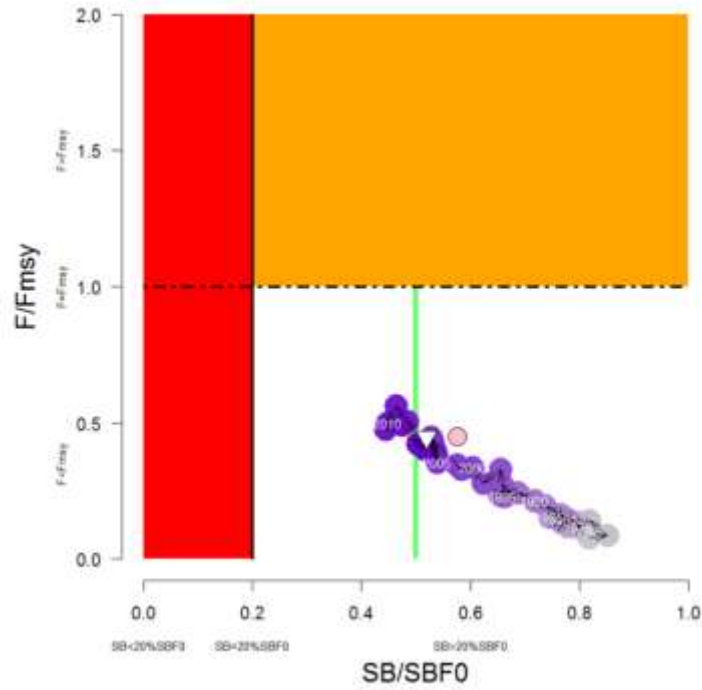


Figure SKJ5: Temporal trend for the reference case model (top) and the structural uncertainty grid (bottom panel) in stock status relative to $SB_{F=0}$ (x-axis) and F_{MSY} (y-axis). The red zone represents spawning potential levels lower than the agreed LRP, which is marked with the solid black line ($0.2SB_{F=0}$). The orange region is for fishing mortality greater than F_{MSY} ($F=F_{MSY}$; marked with the black dashed line). The green line indicates the interim target reference point $50\%SB_{F=0}$.

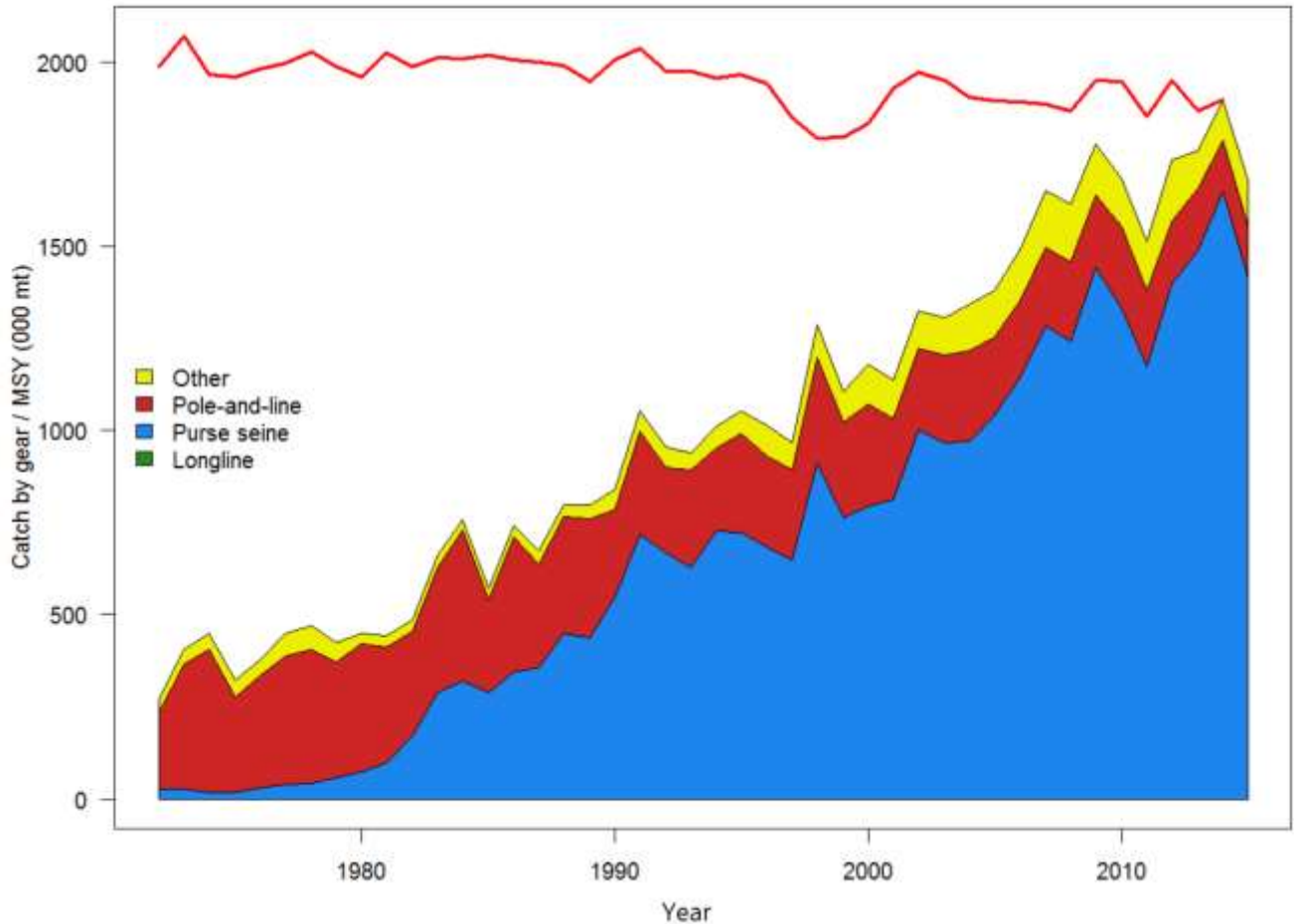


Figure SKJ6: History of annual estimates of MSY compared with catches of three major fisheries for the reference case model.

308. Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass.

309. Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY ($F_{\text{recent}}/F_{\text{MSY}} = 0.45$ for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid $F_{\text{recent}}/F_{\text{MSY}}$ varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock (Figure SKJ 5).

310. The estimated MSY of 1,891,600 mt is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value (Figure SKJ 6).

311. The latest (2015) estimate of spawning biomass is well above both the level that will support MSY ($SB_{\text{latest}}/SB_{\text{MSY}} = 2.56$, for the reference case model) and the adopted LRP of 0.2 $SBF=0$ ($SB_{\text{latest}}/SBF=0 = 0.58$, for the reference case model), and $SB_{\text{latest}}/SBF=0$ was relatively close to

the adopted interim target reference point (0.5 SBF=0) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 5% and 95% quantiles = 0.39 and 0.67).

Alternative view of stock status and trends

312. China, Japan and Chinese Taipei considered it is not possible to select a base-case model from various sensitivity models in the 2016 assessment, given the advice from the Scientific Service Provider that a suite of the sensitivity models were plausible. Therefore, these members considered that it would be more appropriate to provide advice to WCPFC13 on skipjack stock status based on the range of uncertainty expressed by the alternative model runs in the sensitivity analysis rather than based on the single base case model (represented by the 5% and 95% quantiles of the structural sensitivity grid presented in Table SKJ2).

313. The estimated MSY of the WCPO skipjack stock ranges from 1,618,060 mt (5% quantile) to 2,199,880 mt (95% quantile) across the alternative skipjack stock assessment models represented in the sensitivity grid. These CCMs also noted that some alternative models indicate that the 2015 biomass is below the adopted TRP of 0.5SBF=0.

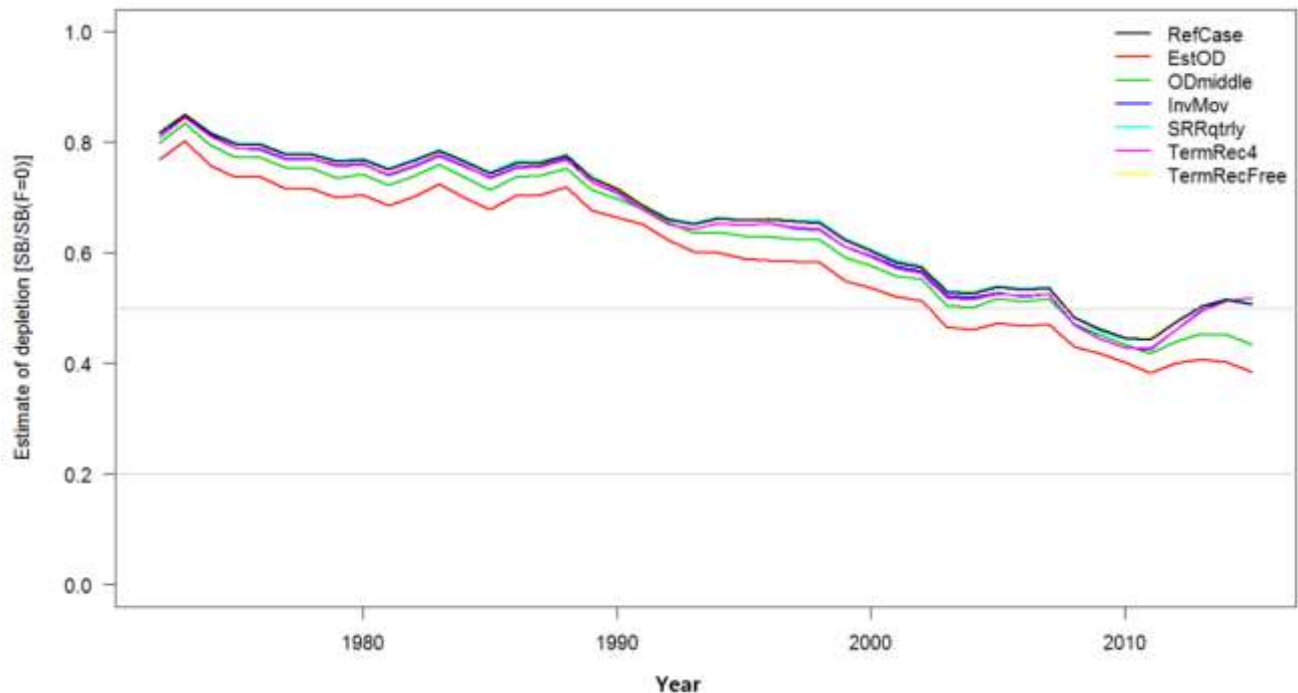


Figure SKJ 7. Estimated fisheries depletion SB/SBF=0, for each of the sensitivity models.

Management advice and implications

314. SC12 noted that the skipjack assessment continues to show that the stock is currently moderately exploited and fishing mortality level is sustainable. The recent catches are fluctuating around and some models also indicate that the stock is currently under the TRP.

315. SC12 noted that fishing is having a significant impact on stock size and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions

associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack tuna catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

316. SC12 noted that skipjack spawning biomass is now around the adopted TRP and SC12 recommends that the Commission take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.

317. In order to maintain the quality of stock assessments for this important stock, SC12 recommends 1) continued work on developing an index of abundance based on purse seine data; 2) regular large scale tagging cruises and complementary tagging work continue to be undertaken in a way that provides the best possible data for stock assessment purposes.

318. SC12 also notes that the current method of calculating the TRP is based on the most recent 10 years of recruitment information. However, the information on spawning potential, SB_{2015} , which is used to evaluate current stock status relative to the TRP can change very rapidly for skipjack which mature at age 1 and this rapid maturation may provide an optimistic status evaluation when recruitment is estimated have an increasing trend but is estimated with substantial uncertainty, as is currently observed in the case of skipjack which does not have a fishery-independent index of recruitment strength.

319. There is ongoing concern by at least one CCM that high catches in the equatorial region may be causing a range contraction of WCPO skipjack tuna, thus reducing skipjack tuna availability to fisheries conducted at higher latitudes than the Pacific equatorial region. SC12 reiterates the advice of SC11 whereby there is no demonstrated statistical evidence for SKJ range contraction. As a result, SC12 recommends that ongoing research on range contraction of skipjack tuna be continued in the framework of Project 67.

320. WWF, Pew Charitable Trusts, Sustainable Fisheries Partnership, and Greenpeace made a statement relating to the integrity and validity of the Commission's scientific process and its requirement to make scientific recommendations based on the best available scientific information. Noting the imperative that SC continue to provide the necessary scientific advice to managers to ensure the appropriate conservation and management of the stocks under its charge unhindered by politics, these observers drew SC12's attention to an analysis provided to WCPFC11 of the legal requirements and obligations of the SC to review and assess (WCPFC11-2014-OP02). The full statement is posted as an NGO paper on the SC12 website.

321. Australia expressed its disappointment that SC12 could not reach a consensus on the provision of scientific advice to the Commission on the status of skipjack tuna, observing that the 2016 assessment incorporated many recommendations from earlier work and had been subject to a range of other improvements over time. Australia considered the assessment to be of a very high standard and was a sound basis for management advice and saw no reason to move away from the standard and most useful practice of adopting a base case for management advice with a clear expression of the uncertainty through the use of sensitivities. Australia associated itself with the majority view and strongly encouraged CCMs to work towards consensus in future.

4.1.4 South Pacific albacore tuna (*Thunnus alalunga*)

4.1.4.1 Review of research and information

322. G. Pilling (SPC) presented SC12-SA-WP-06, Trends in the south Pacific albacore longline and troll fisheries). The paper presents a compendium of fishery indicators for south Pacific albacore tuna, as requested at previous WCPFC-related meetings. Documented indicators include: total catch; catch by gear; and longline effort and nominal longline CPUE trends, along with their spatial patterns. Commentary provided includes comparisons of 2015 values to 2014 and to the average over 2010-14. Information provided includes data loaded into databases as of 2nd July 2016. Some declines in catch and effort were noted based upon available data for 2015 compared to previous years. High seas transshipment data were also presented for the period from the inception of transshipment reporting (July 2010) to May 2016. The stock status from the most recent assessment (2015) was summarised, and an analysis of the potential stock consequences of recent fishing patterns on the south Pacific albacore stock relative to the agreed biomass LRP assuming 2014 status quo effort presented. This analysis uses stochastic stock projections and incorporates the recommendations on inclusion of uncertainty from WCPFC-SC9. Based upon the 2015 stock assessment, and the level of uncertainty included within the projection analysis, the outcomes are essentially unchanged from that seen under the assumption that 2013 conditions continue into the future: there is a 19% chance that the south Pacific albacore stock will fall below the LRP by 2033 under 2014 fishing effort levels. Overall decreases in vulnerable biomass (a CPUE proxy) of 14% in longline fisheries are estimated over that period.

323. In response to a question from Japan on the potential implications for the range of uncertainty that might be introduced by the use of stochastic projections of the stock assessment, SPC noted that the projections were based on the potential uncertainties in the future, including samples from the past, and examined a range of model runs based on these. It was also hoped to sample the uncertainty in age at the end of the assessment and this could possibly result in a higher estimate of uncertainty from the projections. However it was not clear if this would increase the potential risk of breaching the LRP for the stock.

324. Chinese Taipei noted that their longline fleet fishing towards the east of the WCPFC region in the latitudinal band 10-20°S appeared to have high effort but low albacore CPUE, and pointed out that this was likely because that the target species of this region was bigeye rather than albacore. Chinese Taipei further highlighted that target effect may cause false decline of albacore CPUE unless this effect has been addressed, for example, by considering the hooks per basket information.

325. SPC advised that one of the difficulties of analysing CPUE by stock is uncertainty about targeting, and requested that CCMs provide more information about their fishing on the high seas that would help in identifying targeting behaviour.

326. Chinese Taipei noted that the aggregate data provided to the Commission provides the number of hooks per basket, which might be used to determine targeting.

327. In response to a question from EU on the reasons for the different historical CPUE trends in US and NZ troll fisheries for south Pacific albacore, SPC noted that the two fleets were fishing in different areas, with the NZ trollers mainly in the New Zealand EEZ and the US trollers on the southern high seas.

328. FFA members noted that the geographic distribution of total catches is concentrated within the 10-20°S latitude band and that the south Pacific albacore fishery continued to be dominated by EEZ catches. These CCMs noted that in SC12-SA-WP-06 VMS data indicate a 5 year trend of increasing high seas percentage of total VMS days. FFA members viewed with caution the general increase in longline

effort south of 10°S in both EEZs and high seas in the last 5 years, with overall effort in 2015 the lowest since 2010. These CCMs noted that, like other fleets, SIDS domestic fleets which are dependent on albacore continue to experience diminishing CPUE, affecting profitability. To improve the economic situation of the south Pacific longline fishery, FFA members asked that SC recommend strengthening SC's advice and that the Commission adopt a TRP for south Pacific albacore along with precautionary risk levels.

329. China expressed concern about the transparency of the stock assessments, commenting that scientists from CCMs should participate in the stock assessments.

330. SPC noted that pre-assessment workshops are held, typically in April each year, and all CCMs are invited to participate. At those workshops, CCMs provide valuable information and advice. SC further noted that all stock assessment input files, output files and the assessment model software are posted at <http://www.spc.int/oceanfish/en/ofpsection/sam/sam>, which any CCM is able to access and evaluate. The albacore tuna 2015 assessment data files were made available to China to conduct a parallel analysis available in SC12-SA-IP-18.

331. The theme co-convenor stressed that this was a very transparent process. CCMs have full information available for all the stock assessments. CCMs had access to input data and the modelling platform (MULTIFAN-CL) was available for download.

4.1.4.2 Provision of scientific information

332. During the recommendation session, CCMs discussed whether they would include some language about the projections and the risk of breaching the LRP, and whether economic conditions should be included. It was noted that declining trends were evident in the economic conditions. Some CCMs commented that there had been some concerns about accuracy of the nominal CPUE, with one CCM commenting that its fleet did not have declining catch rates.

Stock status and trends

333. SC12 noted that no stock assessment was conducted for South Pacific albacore tuna in 2016. Therefore, the stock status description from SC11 is still current. For further information on the stock status and trends from SC11, please see <http://www.wcpfc.int/node/26922>.

334. SC12 noted that the total south Pacific albacore catch in 2015 was 68,594 mt, 16% lower than both the catch in 2014 and the average catch for 2010-14.

335. Longline south Pacific albacore catch in 2015 was 17% lower than that in 2014, while troll catch in 2015 was 16% higher than that in 2014.

336. SC12 considered an update of trends in South Pacific albacore fisheries (SC12-SA-WP-06) and noted that there had been some small reductions in southern longline effort in 2014 compared to 2013, but 2015 effort levels are currently considered uncertain. Status quo projections were calculated, assuming current southern longline and troll fishery effort would continue into the future at levels equal to those seen in 2014 (based on the information available to SPC as at 2nd June 2016). Potential future spawning biomass levels relative to unfished levels were examined, and the probability that the south Pacific albacore stock may fall below the biomass Limit Reference Point was calculated.

337. If 2014 fishing effort levels continue into the future, the stock is predicted to continue to decline on average, falling to a projected spawning biomass depletion of $SB_{2033}/SB_{F=0} = 0.32$ in 2033. The risk of falling below the LRP was estimated to be 19%. Furthermore, the CPUE was estimated to decline by 14% from 2013 levels.

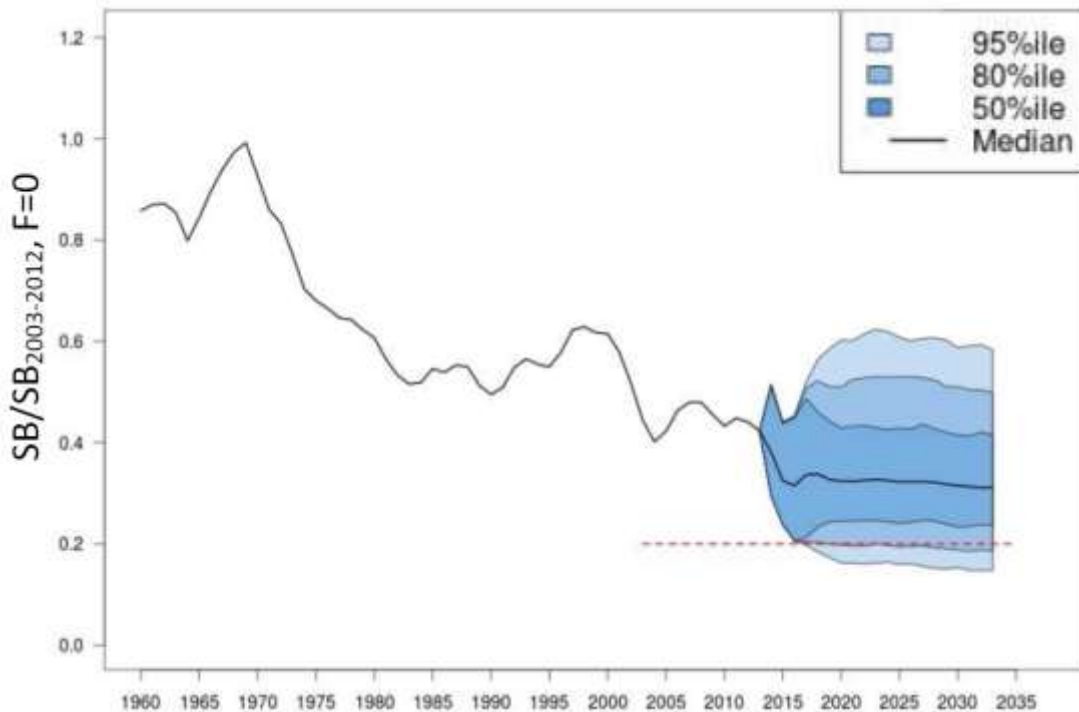


Figure SPA1 (Figure 10 from SC12-SA-WP-06). Stochastic projections of adult stock status under 2014 longline and troll effort levels. The limit reference point (20% $SB_{F=0}$) is indicated by the horizontal dashed red line. Note that from 1960 up to 2013 inclusive the line represents the median across the 9 assessment model runs (structural uncertainty only); uncertainty after 2013 represents both structural uncertainty and stochastic recruitment.

Management advice and implications

338. SC12 noted that no management advice has been provided since SC11. Therefore, the advice from SC11 should be maintained, that longline fishing mortality and longline catch be reduced to avoid further decline in the vulnerable biomass so that economically viable catch rates can be maintained. SC12 also noted that the results of the indicator analyses supported the stock status results for South Pacific albacore that were obtained from the 2015 assessment.

339. Based on the indicator analysis, SC12 also advised that there is a 19% chance that the south Pacific albacore stock will fall below the Limit Reference Point by 2033 if 2014 fishing effort levels continue, and that overall decreases in vulnerable biomass (a proxy for longline CPUE) of 14% would also be likely to occur.

340. SC12 recommends that the Commission note the information presented on economic conditions in the south Pacific longline fishery. Information in SC12-ST-WP-04 indicated that declining catch rates are contributing to declines in economic conditions that are likely to undermine profitability in the fishery.

341. FFA members noted that this is impacting the viability of their fishing fleets and noted that this reinforces the need for management.

4.2 Northern stocks

342. J. Brodziak presented SC12-GN-IP-02, the report of the 16th Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean on behalf of the ISC Chair. In 2016, the ISC PBFWG and BILLWG conducted stock assessments for the Pacific bluefin tuna and Pacific blue marlin stocks, which were reviewed at the ISC Plenary meeting. The 16th ISC Plenary meeting, held in Sapporo, Hokkaido, Japan from 13-18 July 2016 was attended by members from Canada, Chinese Taipei, Japan, Korea, and the United States as well as the Western and Central Pacific Fisheries Management Commission. The Plenary reviewed results, conclusions, new data, and updated analyses of the Billfish, Albacore, Shark and Pacific Bluefin tuna working groups. The ISC16 stock assessment information and conservation advice for Pacific bluefin tuna and Pacific blue marlin was presented at SC12 for consideration by the WCPFC.

4.2.1 North Pacific albacore (*Thunnus alalunga*)

4.2.1.1 Review of research and information

343. No stock assessment was conducted for North Pacific albacore in 2016.

344. FFA members noted that progress had been made to rebuild the North Pacific albacore stock but observed that the catch was back up to the same levels that prompted the Commission to introduce CMM 2005-03. These CCMs noted that the Commission had not agreed reference points for northern stocks, including the NP albacore fishery, consistent with those being developed for other WCPFC fisheries, with discussion deferred to the MSE workshop (held in early 2016). FFA members encouraged northern CCMs to consider the outcomes of the MSE workshop and what advice SC might provide to the Commission to support reference points for both northern albacore and swordfish.

345. Japan stated that an early 2000's assessment of the stock evaluated it as being in poor shape, but the current thinking was that the stock is above LRP, being more than 50% of B_0 status. This CCM stated that work on North Pacific albacore was no less advanced than for tropical tunas, including HCRs, and two Management Strategy Evaluation workshops had now been held by ISC.

4.2.1.2 Provision of scientific information

Stock status and trends

346. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific albacore catches is available in the ISC Plenary Report (SC12-GN-IP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

Management advice and implications

347. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.2.2 Pacific bluefin tuna (*Thunnus orientalis*)

4.2.2.1 Review of research and information

348. A benchmark stock assessment for Pacific bluefin tuna was conducted by the ISC in 2016.

349. S. Nakatsuka, Vice Chair of the ISC Pacific bluefin tuna Working Group, (Japan) presented SC12-SA-WP-07, the ISC-PBFWG Pacific bluefin stock assessment. ISC conducted a benchmark assessment using the best available fisheries and biological information. For data considered reliable, the base-case model fits the data well and is internally consistent among most of the other sources of data. The model is substantially improved from the 2014 assessment. The base-case model indicates: (1) SSB fluctuated throughout the assessment period (fishing years 1952-2014) and (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The main conclusions of the new assessment were: a. Stock assessment model was updated for the benchmark assessment 2016, and the base-case model is a substantially improved from the last assessment; b. results are similar with the last assessment; the stock is still at near historic low and current fishing mortality is above the all reference points except F_{loss} and F_{med}; c. the initial rebuilding target of WCPFC would be achieved by higher probability than the level prescribed in the WCPFC CMM, if current WCPFC CMM and IATTC Resolution are strictly complied.

350. RMI noted ongoing progress with the new model SPC was using for stock assessments, but commented that the status of the stock was the same as for the last three years: overfishing is occurring and the stock is in an overfished state. This CCM remained concerned over the level of engagement in the process by WCPFC, including its subsidiary bodies, to come up with strong recommendations for the stock throughout its range and stressed that the matter was one for all subsidiary bodies and members. This CCM enquired what recommendation should be formulated, given the need for catch reduction and stock recovery, and commented that using a model was one thing but catch and effort needs to be reduced.

351. S. Nakatsuka commented that an interim rebuilding target for Pacific bluefin tuna had been agreed by the Commission, which is a more advanced situation than for bigeye, in the sense that bigeye tuna does not have an agreed the recovery target and specific measures to achieve it. Pacific bluefin tuna's status was not very good but a very strict measure was in place, particularly to reduce juvenile catch, which has only been in place since last year. While the primary impact is on the juveniles, it will be incorporated in the spawning biomass in 3-5 years and analysis says recruitment is maintained above pessimistic level and under the current measure future projection results indicated the recovery to the initial target with above 60% probability under the current CMM even if low recruitment was assumed.

352. Australia asked for further information about the uncertainties related to pre-1952 data, noting that the Pacific bluefin tuna assessment years start in 1952. This CCM commented that in 2014 the stock was estimated to be at 2.6% of its virgin biomass, while the stock was already at ~16% in 1952.

353. S. Nakatsuka noted the higher uncertainty of estimated SSB for the early assessment period, as a result of the data-poor situation before 1970s. It was unknown why the biomass level straight after WW2 was so low but some data suggest that the Japanese Pacific bluefin tuna catch prior to the war was significant as it is a coastal species. According to some reports the catch may have been three or four times current catch.

354. EU noted that the assessment had improved standardization of the indices of abundance, growth estimates, review of catches and reduced uncertainties from previous assessments, but noted that a. the depletion ratio in the terminal year (2014) is very low, 2.6%, with a recent slight increase from the value

of 2.1% in 2012 and b. the last three recruitments are at the lowest levels observed since 1980. The advice of ISC was observed to be that under all examined scenarios the initial goal of WCPFC, rebuilding to SSBMED by 2024 with at least 60% probability, will be reached including the scenario that assumes the full implementation of the both WCPFC and IATTC measures. EU noted the IATTC presentation had recommended extending the measures for two more years and encouraged WCPFC to adopt additional measures to reduce the catch of adults in order to reduce the risk of recruitment collapse. In order to properly frame the initial rebuilding target currently defined by the CMM (the median of the SSB of the SA period, 42,592t), EU asked about the equivalence in depletion ratio.

355. S. Nakatsuka noted that even assuming a low recruitment level it is projected to achieve the target and if there are additional measures the juveniles will have even greater prospects. He acknowledged the IATTC scientific staff recommendation had been provided due to concerns of recruitment collapse; analysis says recruitment is maintained above pessimistic level and under the current measure future projection results indicated the recovery to the initial target with above 60% probability under the current CMM even if low recruitment was assumed.

356. EU expressed interest in SC having more information on the 2015 recruitment survey conducted by Japan to understand the degree of improvement. EU indicated that in the context of the discussion on the timeframes to rebuild bigeye to the LRP scenarios ranged from values between 0.2 and 0.28. These depletion values, 0.2 for example, the LRP adopted for tropical tunas and south Pacific albacore, describe an undesirable state of the SSB that should be avoided with high probability. In order to frame properly the initial rebuilding target currently defined by the CMM (the median of the SSB of the SA period, 42,592t), EU asked about its equivalence in terms of a depletion ratio.

357. S. Nakatsuka commented from memory that it was ~7-8%. Regarding the LRP, he commented that the agreement was to set LRPs species by species, and WCPFC had the highest LRPS among the RFMOs, commenting that 20% is not a universal.

358. SPC asked a number of technical questions about the assessment. In response, Japan commented that: the current Pacific bluefin tuna assessment used areas-as-fleets approach, which could address the spatial structure of fisheries by fleet definition; all abundance indices for age-0 and adult come from WCPO fisheries only, these sized fish are not distributed in the EPO; Australia and New Zealand catch was included in the assessment model. Further information is needed from those countries if the range contraction of Pacific bluefin tuna is to be evaluated. Regarding the initial rebuilding target (SSB_{med}), Japan noted that the ISC recommended defined SSB_{med} for a fixed period to prevent the target moving from year to year. It was explained that the current initial rebuilding target was defined by the Commission in the CMM in 2014. Regarding Pacific bluefin tuna in the south Pacific, it was not a major proportion of the catch. It was not know why Pacific bluefin tuna move to the south Pacific; it is not thought there is a spawning ground there but there was not enough information. Regarding the projection, Japan noted that ISC's current low recruitment scenario assumes re-sampling of around 80-89 and noted the recommendation to monitor the recruitment carefully. Regarding troll CPUE, it was noted that there is more information for this Pacific bluefin tuna fishery. Regarding spatial structure, the assessment assumed a mixed model; the fish are born around Japan and move to the south Pacific, make a transpacific migration to the EPO then come back to Japan to spawn, with the index for the western side. Japan noted that ISC is still working on the spatial structure.

359. It was unclear to FFA members how the spawning biomass could go any lower without the risk of becoming functionally extinct. In light of the SSB estimate of about 9,000 t below the terminal year estimated in the 2014 assessment and the scaled down estimated value of SSB related to improvements to the input data and refinements to the assessment model, these CCMs asked if SSB estimates scaling down between assessments is always driven by model improvements and data inputs, and not because SSB is

actually declining. It was noted that this assessment did not take into account data on the potential effects on age-specific fishing mortality as a result of WCPFC and IATTC measures starting in 2015 or by other voluntary measures. It was noted that age-specific fishing mortality increased up to 96% (age 2) and serious action was required to rebuild this stock. FFA members observed that it was a matter for all CCMs.

360. S. Nakatsuka explained that ISC evaluated the current WCPFC and IATTC measures and their performance under certain circumstances; based on that information, the Commission can take further action if it chooses. Regarding the reduction in absolute value of biomass (about 9,000 mt compared with 2012 terminal years), it was noted that the overall trend was downshifted and the trend was slightly increasing. ISC was more confident in the relative trend than the absolute value.

361. Australia shared the concern of some other CCMs and queried why the Commission was not consistent in its stock rebuilding targets, i.e. using 20% rebuilding target for one stock and a much lower one for another stock, given the low spawning biomass and potential recruitment collapse for Pacific bluefin.

362. The theme co-convenor noted that the rebuilding target in the paper was interim.

363. S. Nakatsuka noted that the Commission had decided the current interim target, so that was the subject of the analysis. Noting that 98% of the fish are caught before maturity, Japan explained that the Commission had sought through the measure to reduce the number of juveniles caught before they could reproduce; there has been the recruitment of tens of millions of fish; bluefin tuna are very productive. He noted the Atlantic and southern bluefin tuna recoveries.

364. The theme co-convenor noted that the target, the timeframe and the probability of achieving the target are interrelated.

365. USA noted that a more rigorous assessment had been undertaken than in 2014, but queried the validity of the SSB_{med} and suggested that the time period should have been specified. This CCM noted the substantial catches prior to 1952, with catches of 20-30,000 tonnes in the 1930s estimated, and asked why these data were not included in the assessment.

366. S. Nakatsuka noted that ISC recommended defining SSB_{med} for a fixed period to prevent the target moving from year to year. It was explained that current initial rebuilding target was defined in the CMM in 2014. He made the point that with 60 years of data adding one or two more points would not change it substantially. Regarding historical catch, data from after 1952 is used in part because Japan introduced a logbook after 1950 and the quality of the data is stronger. He commented that the period is somewhat arbitrary and some might say it should be even shorter (i.e. after 1970s).

367. EU asked whether the latest trends in catch and effort for Pacific bluefin tuna could be presented as it would help shaping the management advice. This CCM referred to the CMM for Pacific bluefin tuna which says that an emergency rule will be developed in 2016 for them to implement when there are drastic drops in recruitment.

368. S. Nakatsuka commented that the presentation does not include 2015 catch, but noted that the catch decreased substantially to around 11,000mt, a 10-20% reduction compared to 2014. Japan advised that the ISC plenary report included the 2015 catch figures. Regarding the emergency rule, Japan commented that recruitment information was important but it was hard to define 'collapse' of recruitment, noting that the emergency measure was agreed by NC and the Commission without input from SC or ISC.

369. New Zealand informed SC that the CCSBT management procedure was introduced in 2011; the stock assessment had indicated that the stock was very low, about 3-6% of B_0 . Before the management procedure was even adopted, CCSBT had cut quotas by about a third to promote rebuilding. In 2011 the suggested that the TAC could be raised, but the Commission decided not to do so in order to hasten rebuilding. In 2014, the juvenile indices (fishery-independent aerial survey) had suggested an increasing trend in recruitment which gave the Commission confidence to increase the TAC. This CCM asked whether a fishery-independent index was being developed through a troll survey or something similar.

370. Japan commented that good recruitment indices and fishery independent data is preferred where available, and noted that most areas for spawning have been identified. This species spawns in remote areas, and if they get to juvenile stage it becomes fast and is hard to catch for a quantifiable level, so information from actual commercial operation is used as recruitment index. Aerial surveys are used for southern bluefin tuna but it fluctuates drastically and there is currently not a good alternative, although Japan continues to work on this.

371. Regarding the emergency rule, PNG commented that from the discussion if there is a recruitment failure this will trigger some sort of management action, and asked what the level of recruitment failure is and what a 10-20% reduction of the current recruitment would mean for the stock in its current state.

372. S. Nakatsuka stated that the stock has been estimated to have viable recruitment in the past. A pessimistic analysis assumes around 8 million fish recruitment on average, which is about 2/3 of the overall average. Japan noted that if the recruitment goes down continuously from the assumed pessimistic scenario, additional measures may be required to achieve the initial rebuilding target.

373. A discussion took place around whether the current low recruitment constituted a 'drastic drop'. The theme co-convenor suggested that it was pertinent to define terms, especially around the emergency measure.

374. EU commented that Pacific bluefin tuna recruitment was at a historical low level and questioned whether zero recruitment was required before it is considered to be a drastic drop. This CCM stressed that management advice was part of SC's role, and opined that the Commission would not be able to make informed decisions if SC could not provide advice on that emergency rule.

375. S. Nakatsuka advised that the CMM for Pacific bluefin tuna requires information to be provided on effort. Regarding the emergency rule and 'drastic drop', he noting that, from ISC's point of view, the question was whether it was needed.

376. RMI emphasised that WCPFC has a rebuilding target in CMM 2015-04 and that should be the ultimate goal. This CCM stated that even with the emergency rule it is likely to fall short and a drastic cut needed to be made and questioned what advice SC can give to achieve the targets in the CMM.

377. S. Nakatsuka commented that based on the analysis even under a pessimistic recruitment scenario the target will be achieved.

378. SPC noted the LRP adopted in IATTC was based on 50%R0 estimated with a steepness of 0.75 and suggested this as a place to start.

379. EU supported SPC's idea, and RMI's sentiment, noting that the analysis from Japan on the prospects for Pacific bluefin tuna is more optimistic than for bigeye tuna.

380. The theme co-convenor noted that the resolution of what ‘drastic’ means is the type of definition SC12 can come to a consensus on during the meeting and asked that a group of interested CCMs organise in the margins to discuss the term.

381. S. Nakatsuka noted that if there is a drop, it is scientifically possible to calculate a new catch level which will enable the target recovery to be achieved. He commented that SC would need a new projection which could not be done during the meeting.

382. Noting the projections showing that under current management and low and highly variable recruitment conditions there was less than a 1 percent chance that the population will return to healthy levels within the next 20 years, The Pew Charitable Trusts, WWF, the Sustainable Fisheries Partnership and Greenpeace stated that it was critical that SC take a lead role in providing stronger scientific advice to managers, recommending a time-bound rebuilding plan and advice on appropriate reference points that will lead to recovery and maintenance of the population at healthy levels. These observers recommended that SC12 should provide advice that to retain an acceptable level of risk the rebuilding target should be increased from the current target of less than 7%. It was further recommended that SC12 provide appropriate scientific advice it considers relevant to properly inform managers, which did not require a request from NC.

383. The Pew Charitable Trusts and Greenpeace stated that the situation could continue as is, and noted that in many domestic fishery management settings, this fishery would be closed, given the current estimate of 2.6% of unfished levels. These observers called for an initial 2 year commercial fishing moratorium to end overfishing and ensure Pacific bluefin tuna has a chance of recovering while the appropriate management regime and rebuilding target are developed.

4.2.2.2 Provision of scientific information

384. On 8 August, the theme co-convenor distributed a draft Pacific bluefin tuna stock status and trends and management advice and implications section of the report for discussion. The theme co-convenor asked CCMs, primarily Japan, to provide text about catches in 2015 in comparison with catches in 2014 with a percentage change.

385. Japan made a preliminary comment that SC12 did not discuss a particular LRP for Pacific bluefin tuna and did not support a recommendation from SC12 along those lines.

386. The theme co-convenor noted the diverse viewpoints which had been put forward and SC12 would consider what can be put forward to managers scientifically.

387. RMI made a preliminary comment that time is of the essence and SC12 should provide firm advice and options from SC for managers.

388. During the recommendation session, discussions among CCMs included the LRP which had been chosen for this species, compared to some other species being managed through such strategies. It was noted that no information was presented at SC12 for choosing reference points, and that the LRP for Pacific bluefin tuna had been determined in NC through dedicated discussions. Biomass limits adopted by RFMOs can range from 7% – 20% of unfished biomass level. One CCM noted that Pacific bluefin tuna has been below the LRP throughout the assessment period. One CCM noted that LRPs should be set species by species. It was noted that the next Pacific bluefin tuna stock assessment should look for signals of recruitment towards an interim rebuilding target. There was discussion around whether to include the spawning biomass or depletion ratio in the recommendations.

389. It was noted that Pacific bluefin tuna was a transboundary species which occurs in both IATTC and WCPFC and is managed jointly. Some CCMs noted that NC will have a joint sitting with IATTC on joint management of this species, including LRPs, and opined that it should be NC that puts a recommendation to the Commission rather than SC. Others noted that SC can make direct advice without having to go through another body and SC could recommend that the Commission set an LRP for Pacific bluefin tuna. One CCM considered that recommending LRPs was premature and getting the LRPs for IATTC and WCPFC aligned would be important. It was noted that a management process was underway in the next 2 months.

390. One CCM noted the ISC report's advice that the level of Pacific bluefin tuna recruitment is at its lowest point since 1980. It was noted that the advice to the Commission should reflect a sense of urgency. One CCM noted that there had been no agreed definition for 'drastic drop' at SC12, and including this in the recommendations could show Commissioners how difficult it can be to interpret its directions.

391. Some CCMs raised concerns about range contraction of Pacific bluefin. Some CCMs observed that no statistical demonstration had been provided to support this. It was noted that there was a high probability that depletion would result in range contractions, with environmental factors also likely to have an influence.

392. One CCM noted that SC risked making no meaningful recommendation except the recommendation to develop HCRs and reference points at some stage. Some CCMs were concerned that, given discussions during SC12, advice to the Commission about the skipjack status might sound more pessimistic than that for Pacific bluefin tuna – i.e. a stock at 50% of unfished biomass compared with a stock depleted to a little over 2% of the unfished biomass.

Stock status and trends

393. SC12 noted that ISC provided the following conclusions on the stock status of Pacific bluefin tuna in the Pacific Ocean in 2016 presented in SC12-SA-WP-07 (2016 Pacific Bluefin Tuna Stock Assessment):

The PBFWG conducted a benchmark assessment (base-case model) using the best available fisheries and biological information. The base-case model fits well the data that were considered to be more reliable and is internally consistent among most of the sources of data. The 2016 base-case model is a substantial improvement compared to the 2014 assessment and fits all reliable data well. The base-case model indicates: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2014) and (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The model diagnostics suggest that the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations.

Using the base-case model, the 2014 (terminal year) SSB was estimated to be around 17,000 t (Figure 7-4), which is about 9,000 t below the terminal year estimated in the 2014 assessment (26,000 in 2012). This is because of improvements to the input data and refinements to the assessment model scaled down the estimated value of SSB and not because the SSB declined from 2012 to 2014.

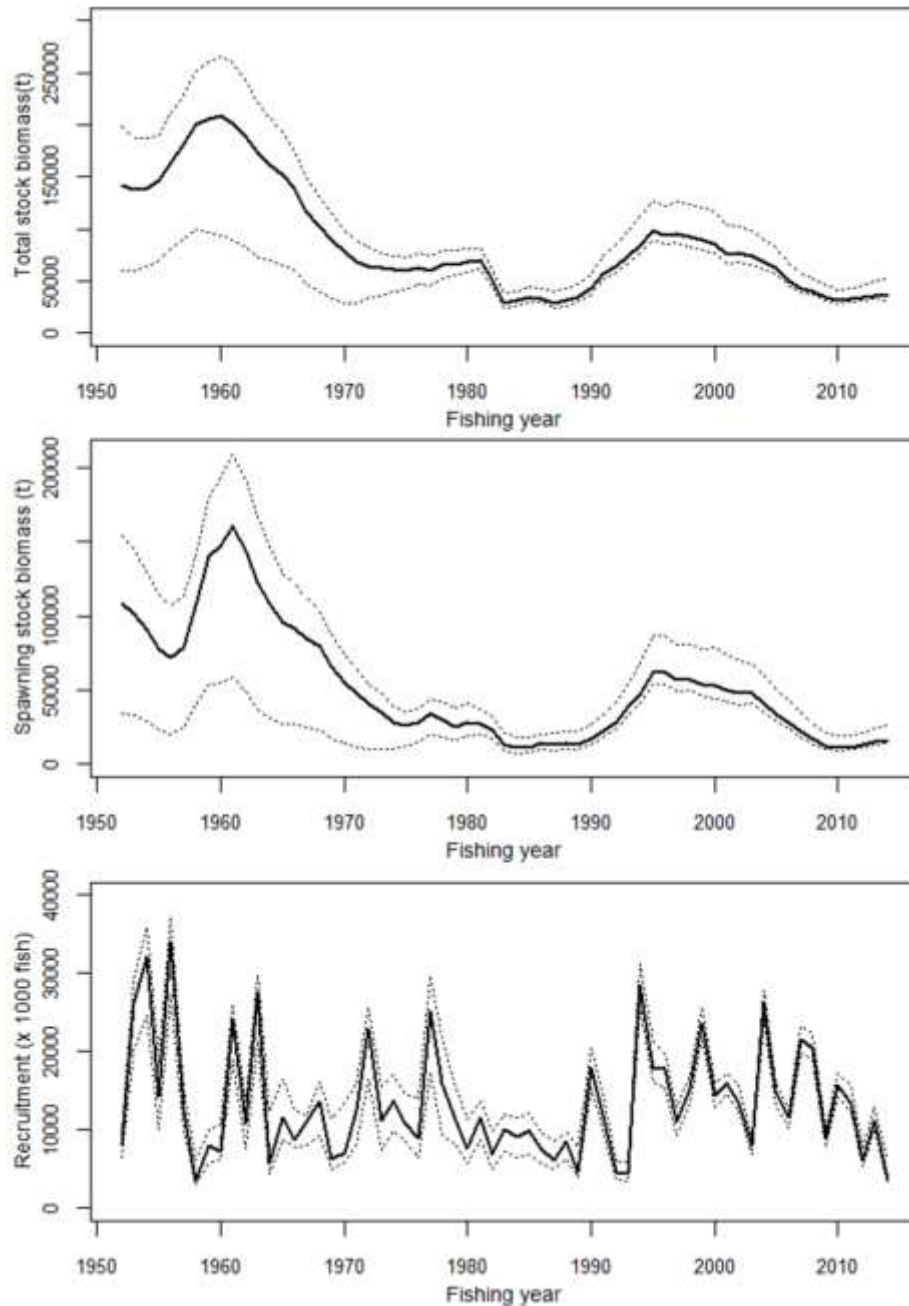


Figure 7-4. Total stock biomass (top), spawning stock biomass (middle) and recruitment (bottom) of PBF from the base-case model. The solid line indicates point estimate and dashed lines indicate the 90% confidence interval.

Recruitment estimates fluctuate widely without an apparent trend. The 2014 recruitment was relatively low, and the average recruitment for the last five years may have been below the historical average level (Figure 7-4). Note that recruitments in terminal years in an assessment are highly uncertain due to limited information on the cohorts. However, two of the last three data points from the Japanese troll CPUE-based index of recruitment, which was consistent with other data in the model, are at their lowest level since the start of the index (1980). Estimated age-specific fishing mortalities on the stock during 2011-2013 and 2002-2004 (the base period for

WCPFC CMM 2015-04) are presented in Figure 7-5. Most age-specific fishing mortalities (F) for intermediate ages (2-10 years) are substantially above F2002-2004 while those for age 0 as well as ages 11 and above are lower (Table 7-1).

Table 7-1. Percent change of estimated age-specific fishing mortalities of PBF from 2002-2004 to 2011-2013.

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
change from F2002-2004 to F2011-2013	-28%	-1%	+96%	+4%	+86%	+43%	-9%	+81%	+21%	+23%	+5%	-5%	-7%	-8%	-9%	-10%	-10%	-10%	-11%	-11%	-11%

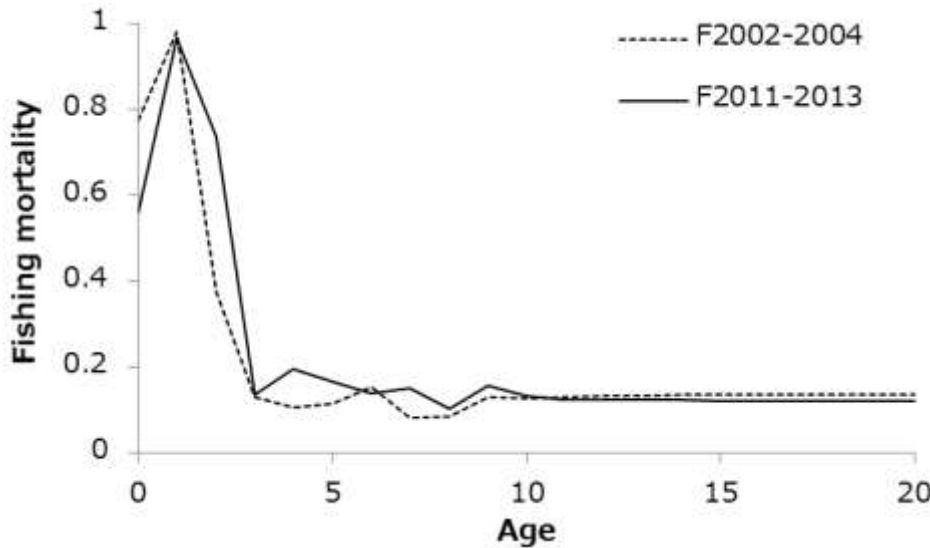


Figure 7-5. Geometric means of annual age-specific (years) fishing mortalities of PBF for 2002-2004 (dashed line) and 2011-2013 (solid line).

Although no limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the $F_{2011-2013}$ exceeds all calculated biological reference points except for FMED and FLOSS despite slight reductions to F in recent years (Table 7-2). The ratio of SSB in 2014 relative to the theoretical unfished⁴ SSB ($SSB_{2014}/SSB_{F=0}$, the depletion ratio) is 2.6%⁵ and $SSB_{2012}/SSB_{F=0}$ is 2.1% indicating a slight increase from 2012 to 2014. Although the $SSB_{2014}/SSB_{F=0}$ for this assessment (2.6%) is lower than $SSB_{2012}/SSB_{F=0}$ from the 2014 assessment (4.2%), this difference is due to improvements to the input data and model structure (Figure 7-4) rather than a decline in SSB from 2012 to 2014. Note that potential effects on Fs as a result of the measures of the WCPFC and IATTC starting in 2015 or by other voluntary measures are not yet reflected in the data used in this assessment.

Since reference points for PBF have yet to be identified, two examples of Kobe plots (Figure 7-6: plot A based on SSBMED and FMED, plot B based on SSB20% and SPR20%) are presented. These versions of the Kobe plot represent two interpretations of stock status in an effort to prompt further discussion. In summary, if these were the reference points, overfishing would be occurring or just at the threshold in the case of FMED; and the stock would be considered overfished. Plot B shows that the stock has remained in an overfished and overfishing status for the vast majority

⁴ “Unfished” refers to what SSB would be had there been no fishing.

⁵ The unfished SSB is estimated based upon equilibrium assumptions of no environmental or density-dependent effects.

of the assessment period if $F_{20\%}$ and $SSB_{20\%}$ are the reference points. The ISC notes that the SSB estimates before 1980 are more uncertain and that the reason why the fishing mortality is estimated to be so high right after the WWII is not well understood. The low biomass level at the beginning of the assessment period (1952) could potentially be the result of relatively high catches prior to the assessment period of PBF.

Table 7-2. Ratios of the estimated fishing mortalities $F_{2002-2004}$, $F_{2009-2011}$ and $F_{2011-2013}$ relative to computed F- based biological reference points and SSB (t) and depletion ratio for the terminal year of the reference period for PBF.

	F_{max}	$F_{0.1}$	F_{med}	F_{loss}	$F_{10\%}$	$F_{20\%}$	$F_{30\%}$	$F_{40\%}$	Estimated SSB for terminal year of each reference period	Depletion ratio for terminal year of each reference period
2002-2004	1.86	2.59	1.09	0.80	1.31	1.89	2.54	3.34	41,069	0.064
2009-2011	1.99	2.78	1.17	0.85	1.41	2.03	2.72	3.58	11,860	0.018
2011-2013	1.63	2.28	0.96	0.70	1.15	1.66	2.23	2.94	15,703	0.024

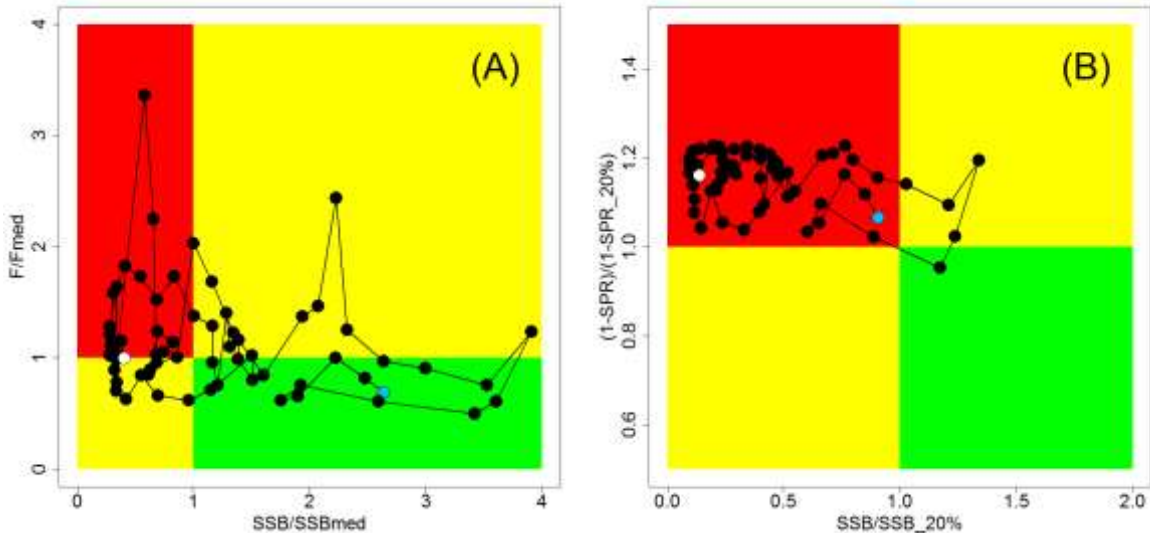


Figure 7-6. Kobe plots for PBF. (A) SSBMED and FMED; (B) SSB20% and SPR20% based. Note that SSBMED is estimated as the median of estimated SSB over whole assessment period (40,944 t) and FMED is calculated as an F to provide SSBMED in long-term, while the plots are points of estimates. The blue and white points on the plot show the start (1952) and end (2014) year of the period modelled in the stock assessment, respectively.

Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish⁶ (age 0-1), have had a greater impact, and the effect of these fleets in 2014 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period (Figure 7-7). This is because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number

⁶ It was noted that the term small fish is not used in CMM 2015-04; however, the measure states “Further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered...”

of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

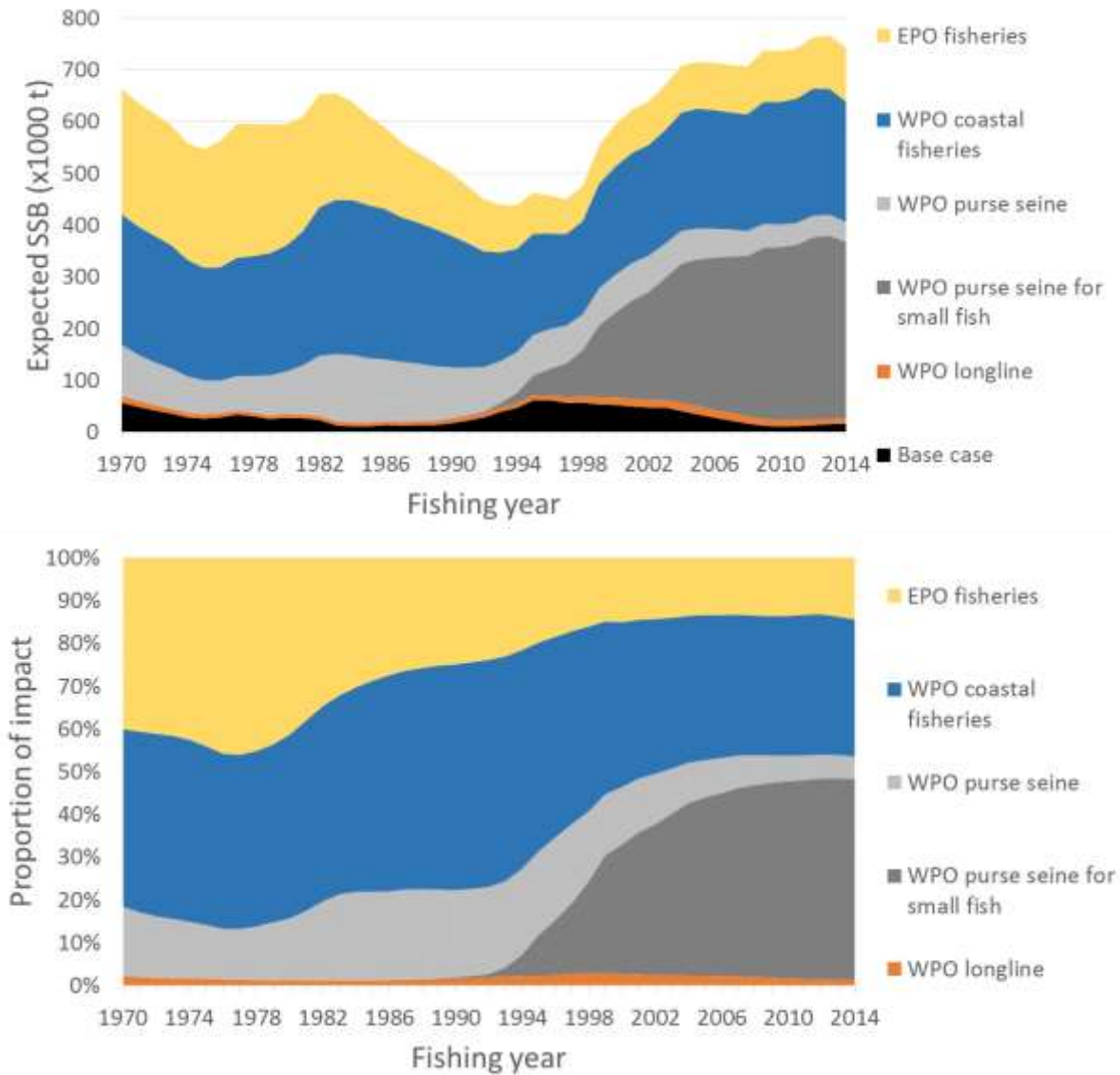


Figure 7-7. Trajectory of the spawning stock biomass of a simulated population of PBF when zero fishing mortality ($F=0$) is assumed and the STET at $F=0$ is the same as estimated in the base-case assessment model, estimated by the base-case model. (Top: absolute impact, bottom: relative impact). Fleet definition; WPO longline: F1, F12, F17. WPO purse seine for small fish: F2, F3, F18. WPO purse seine: F4, F5. WPO coastal fisheries: F6-11, F16, F19. EPO fisheries: F13, F14, F15.

394. In the absence of any agreed definition of a drastic drop in stock recruitment referred to in CMM 2015-04, SC12 notes with concern that the 2012 and 2014 recruitments are at the lowest levels observed since 1980, noting that ISC noted that recruitment in the terminal years of any assessment is highly uncertain. SC12 also noted a comment from Japan that some indices of 2015

recruitment are above the 2014 level and early anecdotal information regarding the 2016 recruitment suggests it is not particularly low.

395. The provisional total Pacific Bluefin tuna catch in 2015 was 11,020 mt in the North Pacific Ocean, which was a 36% decrease over 2014 and a 30% decrease over the average for 2010-2014.

396. SC12 noted that, based on the latest stock assessment carried out by ISC in 2016, SC12 noted that the Pacific bluefin tuna spawning stock biomass is depleted to 2.6% of the estimated unfished spawning stock biomass (SBF=0). SC12 emphasized that this depletion level is considerably below the biomass depletion-based Limit Reference Point of 20% of SBF=0 set by the Commission for all other WCPFC key tuna stocks (skipjack, yellowfin, bigeye, south Pacific albacore and north Pacific albacore). However, SC12 also notes that the Pacific bluefin tuna stock remained below 20% of SBF=0 for most of the time of assessment. SC12 also noted that the initial rebuilding target currently defined by the CMM 2015-04, the median of the SSB of the stock assessment period (42,582 mt) corresponds to a spawning biomass of around 7% of estimated unfished spawning stock biomass.

Management advice and implications

397. SC12 noted the following conservation advice from ISC:

The steady decline in SSB from 1996 to 2010 appears to have ceased, although SSB₂₀₁₄ is near the historic low and the stock is experiencing exploitation rates above all calculated biological reference points except for FMED and FLOSS.

The projection results based on the base-case model under several harvest and recruitment scenarios and time schedules are shown in Table 7-3 and Figure 7-8. Under all examined scenarios the initial goal of WCPFC, rebuilding to SSB_{MED} by 2024 with at least 60% probability, is reached and the risk of SSB falling below SSB_{LOSS} at least once in 10 years was low.

The projection results indicate that the probability of SSB recovering to the initial WCPFC target (SSB_{MED} by 2024, 38,000 t, calculated in the same manner as the previous assessment) is 69% or above the level prescribed in the WCPFC CMM if low recruitment scenario is assumed and WCPFC CMM 2015-04 and IATTC Resolution C-14-06 continue in force and are fully implemented (Table 4: Scenario 2 with low recruitment).

The ISC notes there are technical inconsistencies in the calculation of SSB_{MED} in the assessment and projection. The ISC also notes the current calculation of SSB_{MED} in the projection includes the most recent estimates of SSB and unless a fixed period of years is specified to calculate SSB_{MED}, the calculation of SSB_{MED} could be influenced by future trends in spawning biomass. The ISC therefore recommends defining SSB_{MED} as the median point estimate for a fixed period of time, either, 1952-2012 or 1952-2014. If 1952-2012 is chosen, then SSB_{MED} is estimated to be 41,069 t, and if 1952-2014 is chosen, SSB_{MED} is 40,994 t. The probabilities of achieving 41,000 t under various scenarios are provided in Table 7-3. The probabilities of achieving 43,000 t, where WCPFC CMM 2015-04's initial rebuilding target is specified as 42,592 t, are also provided in Table 7-3, although this value is derived from the previous assessment and is higher than the SSB_{MED} calculated in the current assessment. The ISC recommends that in the future absolute values should not be used for the initial rebuilding target, as the calculated values of reference points would change from assessment to assessment.

Scenario 2 with low recruitment has the lowest prospect of recovery among the examined harvest scenarios. The probability of achieving the WCPFC’s initial target (SSBMED by 2024) would increase if more conservative management measures were implemented as shown in Table 7-3 and Figure 7-8. The projection results indicate that a 10% reduction in the catch limit for fish smaller than the weight threshold in CMM 2015-04 would have a larger effect on recovery than a 10% reduction in the catch limit for fish larger than the weight threshold. (Figure 7-8 (D)). The ISC notes that the current assessment model uses a maturity ogive that assumes 20%, 50% and 100% maturity in age 3 (weight on July 1: 34kg), 4 (weight on July 1: 58kg) and 5 (weight on July 1: 85kg), respectively, while the WCPFC CMM 2015-04 specifies that catches of fish smaller than 30kg should be reduced. The weight threshold in the CMM needs to be increased to 85kg (weight of age 5) if the intent is to reduce catches on all juveniles according to the maturity ogive in the assessment.

The projections results assuming a stronger stock-recruitment relationship (where h=0.9) than in the assessment model are not necessarily more pessimistic than the low recruitment scenario. The projection results assume that the CMMs are fully implemented and are based on certain biological or other assumptions. In particular, the ISC noted the implementation of size based management measures need to be monitored carefully. If conditions change, the projection results would be more uncertain. Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

Table 7-3. Future projection scenarios for PBF and their probability of achieving various target levels by various time schedules based on the base-case model.

Harvesting Scenario #	Fishing mortality	Catch limit *		Threshold of Small/Large	Recruitment scenario **	Probability that SSB exceeds 38,000 tons (SSB median of Bootstrap analysis runs)			Probability that SSB exceeds 41,000 tons (SSB median of Bootstrap model) ***			Probability that SSB is more than 43,000 tons (SSBMED@last assessment)			Probability that SSB is more than 10% of SSB0			Probability that SSB is more than 20% of SSB0			Average Catch	
		Small	Large			2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2024	2029	2034	2019	2024
		scenario 6 in 2014 assessment				30 kg	Low recruitment	77.0%	83.8%	89.9%	69.7%	83.3%	85.2%	64.3%	79.3%	81.9%	14.7%	28.0%	31.8%	0.0%	0.0%	0.1%
Scenario2	F2002-2004	80% of 2002-2004 average catch for WFO fisheries 3,300 tons for EPO commercial fisheries	2002-2004 average catch for WFO fisheries	Average recruitment	69.3%		83.7%	86.6%	61.3%	77.8%	82.3%	56.1%	73.9%	79.0%	13.6%	29.3%	35.4%	0.1%	0.4%	0.6%	11749.7	12994.2
Stock Recruit Relationship w/ h=0.9				98.2%	99.8%		99.9%	97.7%	99.8%	99.9%	97.3%	99.7%	99.9%	99.3%	99.4%	99.9%	72.0%	97.3%	99.6%	13087.3	15020.1	
Scenario3		50% of 2002-2004 average catch		50 kg	Low recruitment	80.5%	91.5%	94.0%	73.3%	87.9%	90.7%	69.1%	85.1%	88.5%	22.2%	43.6%	51.7%	0.2%	0.9%	1.3%	11404.4	12672.3
Scenario4				80 kg	Low recruitment	86.4%	94.6%	96.3%	80.6%	91.9%	94.7%	76.6%	90.0%	93.0%	27.8%	51.8%	61.3%	0.2%	1.1%	1.6%	11292.6	12542.7
Scenario5		90% of scenario 2	same as Scenario 2	30 kg	Low recruitment	90.0%	96.5%	98.1%	83.3%	94.8%	97.0%	81.3%	93.4%	95.9%	35.0%	61.7%	70.4%	0.3%	2.5%	3.7%	11306.4	12881.3
Average recruitment		99.9%	100%		100%	99.9%	100%	100%	99.9%	100%	100%	98.4%	100%	100%	82.2%	97.8%	99.3%	12442.0	14126.3			
Stock Recruit Relationship w/ h=0.9		99.4%	100%		100%	99.2%	100%	100%	99.1%	100%	100%	97.0%	99.3%	100%	81.8%	99.0%	99.9%	12576.4	14448.2			
Scenario6		same as Scenario 2	90% of scenario 2	30 kg	Low recruitment	75.3%	88.2%	90.2%	67.2%	82.9%	86.5%	61.7%	78.6%	83.4%	15.7%	32.5%	38.7%	0.1%	0.5%	0.7%	11496.2	12632.4
Average recruitment		99.7%	100%		100%	99.6%	100%	100%	99.3%	100%	100%	96.8%	99.9%	100%	75.1%	95.2%	98.1%	12686.3	14071.5			
Stock Recruit Relationship w/ h=0.9		98.9%	99.9%		100%	98.6%	99.9%	100%	98.4%	99.9%	100%	95.0%	99.7%	100%	75.5%	98.0%	99.9%	12761.0	14379.7			
Scenario7		90% of scenario 2	30 kg	Low recruitment	90.3%	96.8%	98.3%	86.2%	93.4%	97.6%	82.7%	94.2%	96.8%	39.4%	68.0%	77.4%	0.5%	3.5%	5.6%	11231.0	12607.1	
Average recruitment	99.9%	100%		100%	99.9%	100%	100%	99.9%	100%	100%	98.5%	100%	100%	83.5%	98.1%	99.6%	12139.4	13461.7				
Stock Recruit Relationship w/ h=0.9	99.2%	100%		100%	99.1%	100%	100%	99.0%	99.9%	100%	96.9%	99.3%	100%	81.6%	99.0%	99.9%	11227.3	12461.8				
Scenario8	80% of scenario 2	same as Scenario 2	30 kg	Low recruitment	97.5%	99.6%	99.9%	96.1%	99.3%	99.7%	94.8%	98.9%	99.5%	65.4%	89.2%	94.0%	1.9%	14.5%	22.8%	10922.8	12688.4	
Scenario9	same as Scenario 2	80% of scenario 2		Low recruitment	78.1%	89.9%	92.5%	70.4%	83.6%	88.3%	65.0%	81.9%	86.3%	18.4%	37.1%	44.7%	0.2%	0.6%	0.9%	11327.0	12329.9	
Average recruitment	98.3%	99.8%		99.9%	97.4%	99.6%	99.9%	96.3%	99.5%	99.8%	73.2%	93.8%	97.5%	3.1%	22.4%	34.1%	10583.9	11586.4				
Scenario10		80% of scenario 2	30 kg	Average recruitment	100%	100%	100%	100%	100%	100%	100%	100%	99.7%	100%	100%	91.0%	99.5%	100%	11194.1	12104.9		
Stock Recruit Relationship w/ h=0.9	99.8%	100%		100%	99.7%	100%	100%	99.7%	100%	100%	98.7%	100%	100%	90.0%	99.7%	100%	11227.3	12461.8				
Low recruitment	82.6%	93.0%		95.0%	75.9%	89.9%	92.1%	71.3%	86.4%	89.9%	25.6%	46.2%	56.0%	0.1%	1.2%	1.6%	12266.8	13587.4				

* Catch limits for EPO commercial fisheries is applied for all the catch (small and large fish) made by the Fleets.

** Average recruitment refers to the recruitment for the whole assessment period while low recruitment refers to that of 1980-1989.

*** Probability that SSB exceeds 41,000 tons (SSB median of Base case model) developed by PBFWG at ISC16 Plenary.

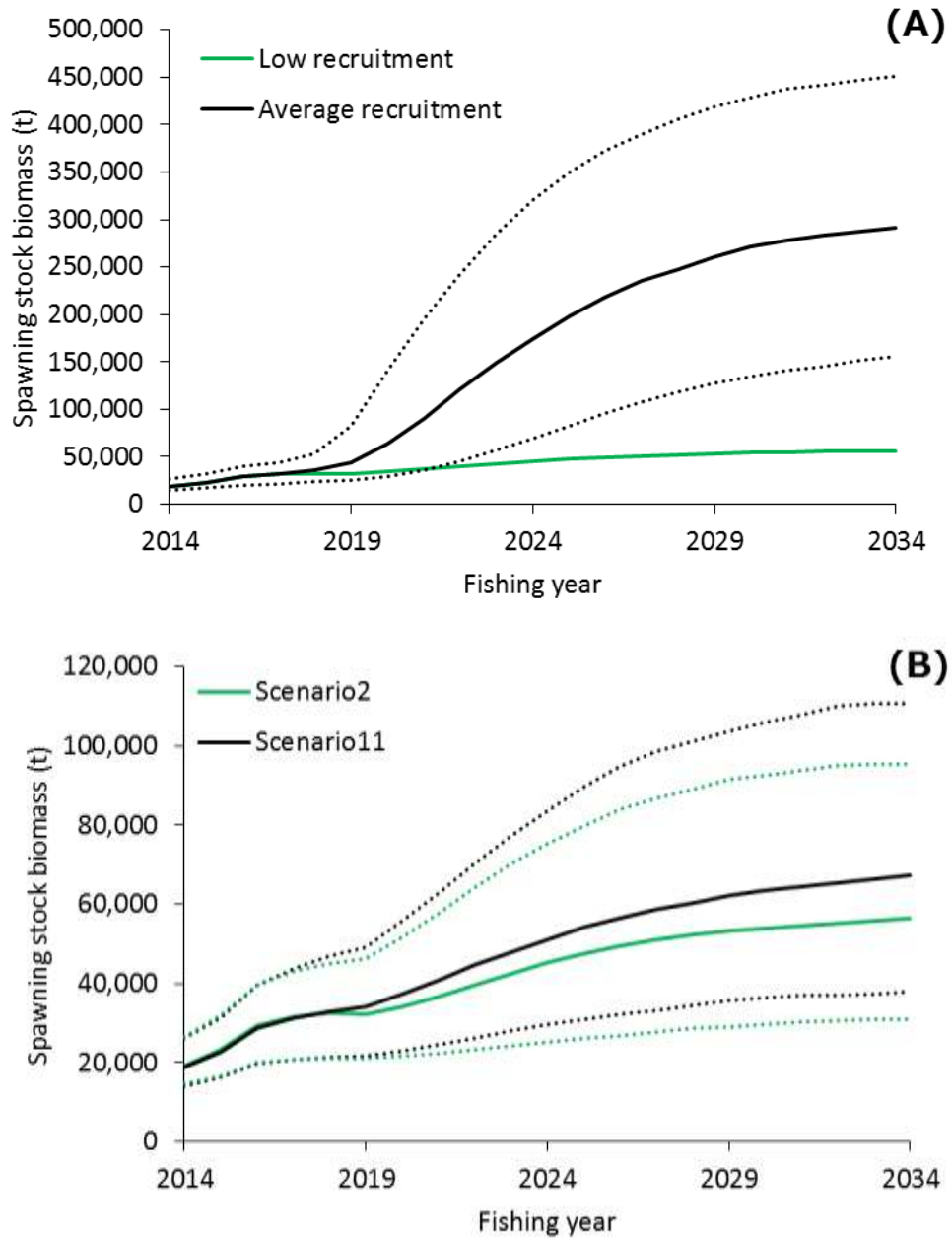


Figure 7-8. Comparisons of various projection results for PBF. (A) Low recruitment vs. historical average recruitment (Scenario 2). (B) Current CMMs (Scenario 2) vs. current F (Scenario 11) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval.

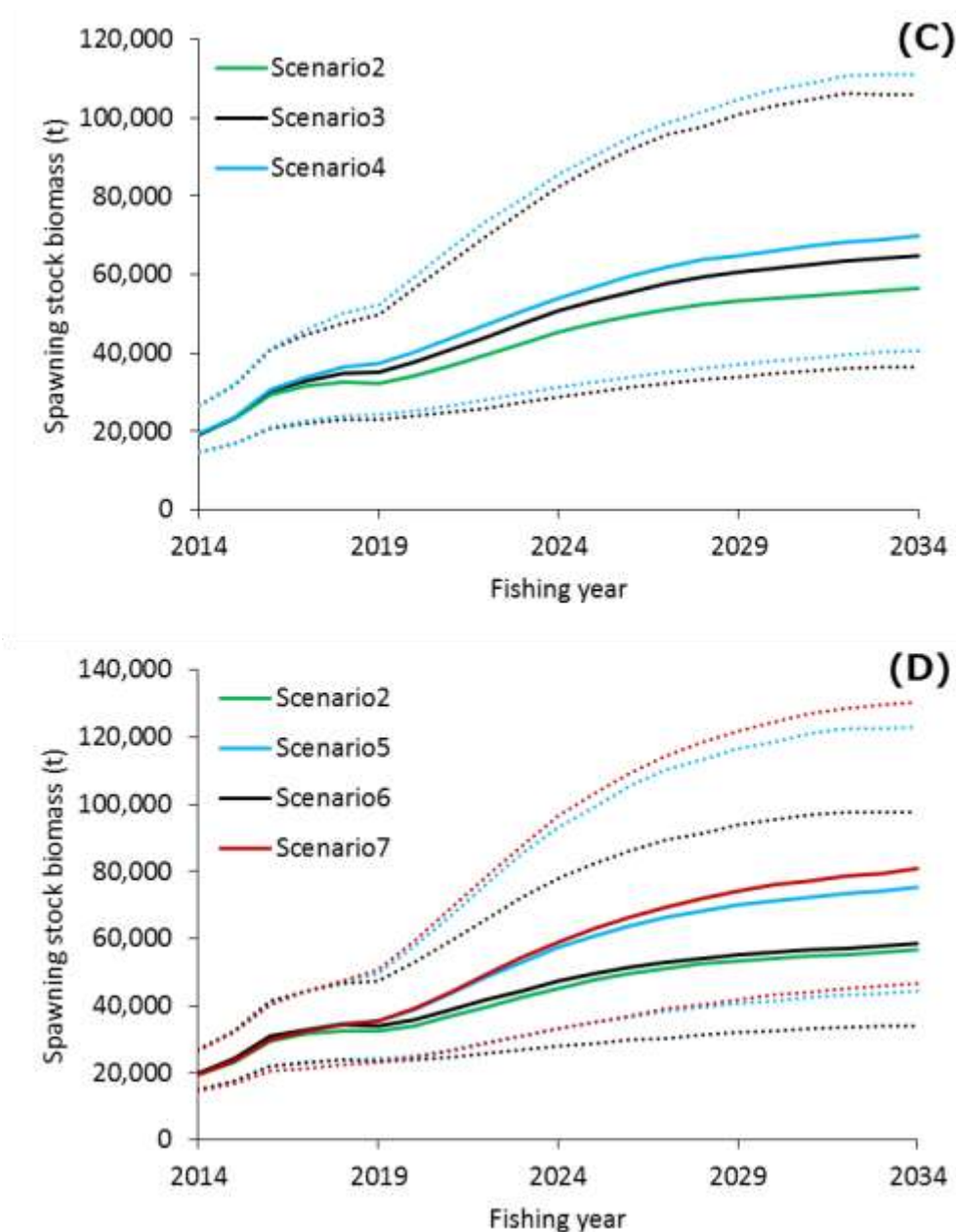


Figure 7-8 (cont.) Comparisons of various projection results for PBF. (C) Different definition of small fish (30kg (Scenario 2) vs. 50kg (Scenario 3) vs. 80kg (Scenario 4)) (low recruitment). (D) Current CMMs (Scenario 2) vs. additional 10% catch limit reduction for small fish (Scenario 5), for large fish (Scenario 6) and for all fish (Scenario 7) (low recruitment). The solid lines indicate median of bootstrapped projection results and dotted lines indicate 90% confidence interval.”

398. SC12 advised WCPFC13 that FFA members expressed concern that the substantial depletion of the Pacific bluefin stock due to excess fishing in the northern WCPFC region has probably resulted in range contraction, thus greatly reducing the availability of bluefin tuna (*Thunnus orientalis*) in the south Pacific. This is of particular significance to Pacific island CCMs

because it limits their future opportunities for the participation in fisheries for this stock. SC12 also noted no statistical demonstration is provided to support the range contraction of Pacific Bluefin tuna. SC12 noted the need for additional information.

399. In view of the upcoming IATTC-WCPFC joint meeting on Pacific bluefin tuna management, SC12 expressed the need of urgent coordinated actions between WCPFC and IATTC in reviewing the current rebuilding plan, establishing the emergency rule as well as considering and developing reference points and HCRs for the long term management of PBF.

4.2.3 North Pacific swordfish (*Xiphias gladius*)

4.2.3.1 Review of research and information

400. No stock assessment was conducted for North Pacific swordfish in 2016. There was no discussion under this item.

4.2.3.2 Provision of scientific information

Stock status and trends

401. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC10 are still current. Updated information on North Pacific ~~albacore~~ swordfish catches is available in the ISC Plenary Report (SC12-GN-WP-02) but was not compiled for and reviewed by SC12. For further information on the stock status and trends from SC10, please see <http://www.wcpfc.int/node/19472>

Management advice and implications

402. SC12 noted that no management advice has been provided since SC10. Therefore, the advice from SC10 should be maintained, pending a new assessment or other new information. For further information on the management advice and implications from SC10, please see <http://www.wcpfc.int/node/19472>

4.3 WCPO sharks

4.3.0 Stock status indicators for key shark species

403. No new information was provided on stock status indicators for all key shark species.

4.3.1 Oceanic whitetip shark (*Carcharhinus longimanus*)

4.3.1.1 Review of research and information

404. The last stock assessment was conducted in 2012 and no stock assessment has been conducted since then. No new information was provided on stock status indicators for oceanic whitetip shark.

4.3.1.2 Provision of scientific information

Stock status and trends

405. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic

whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

406. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.2 Silky shark (*Carcharhinus falciformis*)

4.3.2.1 Review of research and information

407. The last stock assessment was conducted in 2013 and no stock assessment has been conducted since then. No new information was provided on stock status indicators for silky sharks.

408. EU noted the information paper SC12-EB-IP-09, the FAO Report of the fifth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species. It was noted that this report had a section on silky sharks, including their status in the Pacific Ocean. The document would form the basis for discussions at CITES COP17 in Johannesburg, South Africa from 24 September to 5 October 2016.

4.3.2.2 Provision of scientific information

Stock status and trends

409. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

410. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.3 South Pacific blue shark (*Prionace glauca*)

4.3.3.1 Review of research and information

411. A new stock assessment for South Pacific blue shark was conducted in 2016.

412. L. Tremblay-Boyer presented SC12-SA-WP-09, Catch and CPUE inputs to the South Pacific blue shark stock assessment. This paper presented the rationale, methodology and key results for the three catch reconstruction scenarios and the three abundance time-series scenarios that were developed to inform the 2016 South Pacific blue shark stock assessment, including a brief summary of length frequency and tagging data, noting that tagging data was not used in the final assessment. The catch reconstruction approach relied heavily on observer data, given under-reporting of blue shark catches across fleets, especially before 2011. The final reconstructed catch scenarios predict blue shark catches of very different magnitudes over the 1994-2014, with the southwestern Pacific wide CPUE surface catch

scenario predicting the highest catches and the blue shark-to-generic shark catch scenario predicting the lowest catches for most fleets. Similarly, the abundance indices produced under the three scenarios show different trends over time, with the South Pacific observer increasing slightly, the ‘nominal’ Chinese Taipei declining and the New Zealand operational series increasing after being stable in early years. The distribution of length frequency for the main fleets over time underscored the lack of information available in these data, with patchy temporal coverage and no clear annual trend apparent for most fleets. Lastly, a map of available tag recoveries was presented, highlighting that all of the SPC-available regular tagging programs are restricted to the southwestern part of the South Pacific blue shark’s range.

413. Japan expressed some concerns about model complexity and proposed to standardize the catch based on the proportion of the blue shark catch relative to shark catches because proportion by fleet can be affected by other factors including area and time. Japan commented about the estimation of the catch based on the log-normal model, expressing concern about the inclusion of tuna CPUE as an explanatory variable because fishing effort is used in both response and explanatory variables. This CCM asked for more information on the target shark fishery.

414. Tremblay-Boyer noted that in future iterations of the paper the blue shark total catch scenario would be attempted. Regarding the use of swordfish and southern bluefin tuna CPUEs, it was confirmed that the models are based on observer data; as this does not always coincide with the whole dataset, the effort data used in the CPUE metrics are not the same, and so it was considered appropriate to use this approach. Tremblay-Boyer noted that the question related to what constitutes ‘targeting’ was being discussed in a small working group. It was noted that the definition in the paper did not use the definition under discussion in the margins of the meeting.

415. Chinese Taipei noted that Chinese Taipei-Vanuatu CPUE is combined with Chinese Taipei CPUE for DWFN in the model and suggested separating them by flag, noting that while some of the fishing activities are similar it was a different fishery.

416. Tremblay-Boyer noted the comment, and explained that the study wanted to use a DWFN that had high observer coverage. Combining with the Vanuatu-Chinese Taipei vessels boosted the observer data.

417. Chinese Taipei commented that the ratio of blue shark to all sharks in Table 2 is very low, whereas blue shark was about 80% of its shark catch according to industry data.

418. Tremblay-Boyer appreciated this information as it was useful in constructing the model, and noted Japan’s request to have a finer model of the blue shark to all shark ratio.

419. Chinese Taipei commented that the study assumed blue shark mortality of 100% but noted research which suggests blue shark has a high survival rate after release.

420. Tremblay-Boyer noted that this was done because the fate data from observer data sets are inconsistent. Tremblay-Boyer agreed that survival data needed to be a priority for future assessments.

421. Noting that the paper states that catch estimates of non-target species are not felt to be reliable, and in the first catch reconstruction scenario the shark numbers reported by the fleets are assumed to be accurate, Australia asked if a trend in reporting over time would have resulted in a biased trend in the reconstructed catch.

422. Tremblay-Boyer noted the low reporting for sharks overall and the more conservative lower bound catch scenario input was chosen to examine the sensitivity. It was noted that CMM 2010-07 has led to an important increase in reporting.
423. Australia asked whether the assumptions relating to the ratio of blue sharks to all sharks (i.e. constant within fleets over time) and catch rates remaining constant for a fleet in all fishing grounds for a given year were these tested with fleets with sufficient observer data.
424. Tremblay-Boyer noted that a lot of the assumptions can be tested including blue shark to all sharks, and noted Japan's earlier request to use a finer model ratio. Spatial catch rates do not vary over space or over time; the issues were low observer coverage and noise in the data.
425. Australia asked whether the use of oceanographic proxies in these models was a useful line of research, and whether it would have been more appropriate to use the more traditional statistical approach, using spatial-temporal effects such as quarter and area effects.
426. Tremblay-Boyer noted that quarter and area effects can only be used if there is good coverage, and these are typically proxies for productivity. Since the comparison is between the equatorial and temporal regions, the model structure was more robust to seasonal effects across a large spatial scale.
427. Australia noted that this still makes the assumption that there is a correlation between oceanography and catch, which has not been proven yet, though it is potentially a very useful tool to explore in the future.
428. The theme co-convenor noted that correlation with the predicted covariates is a challenge.
429. EU noted that all the data for the EU fleet is available in reports, and noted the ongoing discussion about the definition of targeting. This CCM noted information given about target-switching swordfish and south Pacific blue shark.
430. FFA members supported the 15 recommendations in the working paper to improve data inputs in future assessments pending availability of resources, and reiterated the value of e-reporting and e-monitoring approaches to supplement observer coverage. FFA members noted that without improved data, further work would likely focus on refining the model assumptions and estimates which are uncertain. FFA members considered a data review should be undertaken before committing to this type of assessment in the future and a schedule of work to resolve known uncertainties, for example the collection and analysis of biological data or the development of catch histories.
431. The theme co-convenor noted that FFA's comment on approaches to data-limited stock assessment of sharks was useful for this forum as well as others.
432. S. Clarke noted Australia's questions about the CPUE standardization model. Noting that last year's SPC indicator analysis for south Pacific blue shark showed that CPUE declined from 1995-2003, then became relatively stable between 2004-2009, then declined again between 2010 and 2015. Due to concerns about that decline, the stock assessment for this species was prioritized for this year. The observer data now standardized in this paper shows a different and continuously increasing trend in CPUE. Some of this may be due to additional data, but the amount is probably not a lot more than used last year. Clarke commented that perhaps the difference would be due to the use of a different model. While there may be strengths and weaknesses with the oceanographic and target species model approach used this year, she asked whether the authors compared last year's model with the current dataset to examine why there was such a different CPUE this time.

433. Tremblay-Boyer noted that in this assessment additional data was available, so the dataset is different; there was a lot of data from Chinese Taipei's fleet that was not available before, and some Chinese fleet coverage. But the main difference was likely to be the model used. The usefulness of including influence plots in the future was noted.

434. Indonesia advised that it could support tagging work by returning tags when caught by Indonesian tuna longliners based at Benoa, and advised that data based on the scientific observer program in the Indian Ocean was presented in the IOTC Working Party on Ecosystems and Bycatch which might be valuable for this work.

435. Noting that fishing gear was an important factor in the survival of blue sharks, China proposed to do research in the Chinese fleet on the use of monofilament, as opposed to wire traces, which may increase survival rates. China reported anecdotally that some blue sharks had survived in good condition despite having two hooks in the mouth.

436. The theme co-convenor thanked China for its empirical information on the potential importance of gear to survival rates, and welcomed a future working paper from China on this in the future.

Assessment of blue shark in the southwestern Pacific

437. Y. Takeuchi presented SC12-SA-WP-08, an assessment of blue shark in the southwestern Pacific. This paper presents the 2016 stock assessment of blue shark (*Prionace glauca*) covering the southern hemisphere component of the Western and Central Pacific Fisheries Commission Convention Area (WCPFC-CA) and fisheries for the period 1994-2014. This represents the first attempt to assess this stock. The stock assessment software MULTIFAN-CL was used for the assessment. A number of challenges were experienced in the development of this assessment. Catch data are generally of poor quality and have to be reconstructed, such that both catch inputs and the resulting CPUE time-series are uncertain. A major objective of this assessment is therefore to establish and examine key areas of uncertainty, and the impacts on estimates of stock status. This stock assessment does not present any results that were dependent on SRR estimates, as early attempts to estimate the SRR, even when the steepness parameter was specified, resulted in very large estimates of unexploited equilibrium recruitment and spawning biomass that were considered to be unrealistic. No estimates of MSY-related quantities were possible under these circumstances. Given the encountered issues with available data, generally poor fits to CPUE time series by the model, and uncertainty in the estimated stock recruitment relationship, we view this assessment as a work-in-progress. We do not recommend that the derived stock status estimates be used as the basis for management advice at this time.

438. Japan acknowledged the very data poor situation for this species but noted that other tuna RFMOs work from simple to complicated models to obtain stock status. It was noted that BSPM and SS are less complicated than MULTIFAN-CL. On the question of catch by weight, this CCM requested a comparison of catch with other stocks such as north Pacific blue shark and asked if a small depletion ratio was derived for the analysis.

439. Takeuchi noted that if you compared with blue shark stock assessments in other RFMOs the major contrast is the shorter time series. Both in the Atlantic as well as North Pacific Ocean Japan provided time series for blue shark catch starting in 1971, but not for WCPO. If a simpler model was applied, e.g. the Bayesian Surplus Production Model, there would be difficulties determining stock status. Stock reduction analysis relies on strong assumptions that the assessment begins with unexploited biomass, but this was not the case in 1994. Regarding complexity, MULTIFAN-CL was not so different from the other models. Japan's request for predicted catching rate was possible from MULTIFAN-CL.

440. Japan commented that natural mortality is a constant value and when there are many uncertainties in biological parameters, a simple model should be used to examine effects before moving to more complex models if needed.
441. The theme co-convenor noted there can sometimes be differences of opinion regarding models.
442. Chinese Taipei asked whether the reason of recruitment not being estimated from the model was due to insufficient length frequency data.
443. Takeuchi responded that it was difficult to estimate stock recruitment relationship, although the steepness is fixed in MULTIFAN-CL. So it is very difficult to have reliable MSY-based quantities. However, recruitment is estimated.
444. [Noting information on](#) ~~Regarding~~ stock structure in the north Pacific, Chinese Taipei suggested combining IATTC and WCPFC data in future [South Pacific](#) assessments as there ~~is~~ [are](#) no biological data suggesting they are different stocks [west to east](#).
445. Tremblay-Boyer agreed this was a good idea but because of the difficulty with finding a data set that had a reliable CPUE series for the time period, they may not be able to do this.
446. EU highlighted the uncertainty about the discard rates, which undermined the reliability of the catch estimates. This CCM sought advice on the future work needed to be able to provide advice to the Commission, given the differences in maturity and spatial segregation in the current and last assessments, and recommended that a simpler model be tried so SC12 can provide advice in the short term.
447. Takeuchi noted that age at maturity was based on recommendations from the life history workshop, but did not think it would change the current conclusion.
448. The theme co-convenor noted the complexity of the shark assessment and SC's desire to provide useful management advice.
449. Australia suggested that before undertaking further assessments on sharks it would be prudent to first undertake a focused and comprehensive study on the data available to support such assessments and the construction of related shark indicators. It could assess the quality of the data currently held, identify significant data gaps and the uncertainties implied, identify appropriate data assumptions, consider what types of analyses the data could support, and provide advice on appropriate modelling approaches where the data is considered sufficient. Mechanisms to address the current data gaps should also be identified, e.g. expanding observer coverage for longline fleets which could be included in the recommendations. Australia asked what the main reasons were for the problems with this assessment given the species was less data poor than others, noting that the second catch time-series showed no major trend over time and there were three contradictory CPUE series.
450. Takeuchi responded that the time series available is a typical one way trip situation for the three time series, noting the difficulty of identifying absolute stock size given the short time series, while other shark stock assessment like silky shark had definitive trends that were interpretable.
451. SPC noted that a major issue for this species was the shortness of the time series available and asked whether Japan and/or Chinese Taipei had data on juvenile blue shark catch from the driftnet fishery they could provide towards a future assessment. No response was provided by the CCMs concerned. The difficulty of getting estimates of absolute population size was noted, although some of the new genetic tools may allow for a lower limit on possible population size. Regarding the use of alternate assessment

techniques, SPC noted that these data will be posted on the SPC website if other CCMs would like to conduct these analyses.

452. The theme co-convenor noted the transparent treatment of the south Pacific blue shark assessment data.

453. USA did not think simpler models would be helpful since the issue is data paucity not the modelling platform. Noting the 14 recommendations in the exec summary, this CCM asked SPC to highlight the most important recommendations in the stock assessment.

454. New Zealand noted the proposed improvements and noted that there was not a line item in the draft shark research plan which covers it. The shark ISG should look at ways to improve data for stock assessments.

455. RMI supported New Zealand's comment on need for data improvement, which was a common theme regardless of model used. A recommendation could be clear cut – to reduce data gaps for stock assessment work through observer coverage of the fleets.

456. The theme co-convenor noted the commonality of the comments regarding data and the potential for improving it. There should be a workshop dealing with blue shark and other sharks to avoid the danger of counting blue sharks as other sharks.

457. EU fully supported such a recommendation but feared they will only be able to improve the situation in the long term and would fall short of providing advice in the short term for this key commercial shark species.

458. The theme co-convenor noted the compendium of work in the published literature dealing with data-limited stock. He further noted that this species and other data limited species will be difficult to assess for the foreseeable future until data improves.

459. The SPC South Pacific blue shark assessment team prepared a list of research recommendations for South Pacific blue shark, which is in **Attachment E**.

4.3.3.2 Provision of scientific information

460. During the recommendation session for south Pacific blue shark, CCMs discussed whether to include language about trends in catches and conflicting CPUE time series, whether they would use aggregated 5 x 5 catch data, and how to reflect the research priorities related to the shark research plan. Regarding the presence of blue shark in the Indian and Pacific oceans, it was noted that this same species was in more than one ocean and would need to be considered in future assessment efforts. One CCM raised the prospect of conducting a review of data quality and data gaps for undertaking shark assessments. CCMs discussed language relating to uncertainties since SC could not determine the stock status. Prioritising work regarding the shark research plan was noted. One CCM saw a need to capture important recommendations from the stock assessment to progress towards an assessment status for blue shark, noting that managers may be surprised that SC still has not been able to undertake any assessment of this key species. It was decided that SPC's list of recommendations could be used as general science recommendations.

Stock status and trends

461. SC12 noted that WCPFC has not yet determined limit biological reference points for South Pacific blue shark.

462. SC12 noted that the stock status for shark assessments presented to the Scientific Committee have been traditionally assessed relative to MSY-based reference points. It was also noted that realistic estimates of equilibrium unexploited recruitment and spawning biomass could not be obtained in the 2016 South Pacific blue shark assessment due to the lack of available data, conflicting CPUE time series, and uncertainty in the estimated stock recruitment relationship.

463. SC12 noted that the 2015 catch of south Pacific blue shark provided within aggregate 5-degree square catch data was 26% lower than in 2014, and a 34% reduction over the average for 2010-14.

464. SC12 noted that the 2016 South Pacific blue shark assessment is preliminary and is considered to be a work in progress. As a result, it cannot be used to determine stock status and form the basis of management advice.

465. SC12 noted that there are a number of data uncertainties within the South Pacific blue shark assessment, especially with regard to historical and contemporary longline catch and CPUE estimates. The data-poor nature of the South Pacific blue shark assessment indicates that an improvement in the amount and quality of available biological and fishery information will be required in order to develop a useful integrated stock assessment model.

466. SC12 noted the recommendations in the working papers (SC12-SA-WP-08 and SC12-SA-WP-09) for data improvements and other analytical work needed to improve the assessment for South Pacific blue shark, and recommends prioritizing such work.

Management advice and implications

467. SC12 noted that no management advice has been provided for South Pacific blue shark.

4.3.4 North Pacific blue shark (*Prionace glauca*)

4.3.4.1 Review of research and information

a. Evaluation of North Pacific blue shark as a northern stock

468. The theme co-convenor noted an information paper submitted by J. King, who had prepared a population genetic structure study for North Pacific blue shark (SC12-SA-IP-19, submitted by ISC). The paper concluded that there were no significant differences between the six sampling sites in the North Pacific.

469. Japan noted that SC12 was asked to review any new relevant information provided by ISC to prioritize work on determining the designation of North Pacific blue shark as a northern stock, including establishing a criteria and process for the designation of northern stocks. Japan noted that SPC had been tasked by the Commission with analyzing the available information and coordinating with ISC for further information.

470. SPC (J. Hampton) noted that no specific work on the topic was outlined in SPC's work agreement but noted that ISC provided a reference list on literature available on the topic.

471. The Secretariat advised that there had been little progress in coordinating the issue of designating NP blue shark as a northern stock. Previously, ISC provided detailed information on the NP striped marlin stock which should be designated as a northern stock. As the process failed for the NP striped marlin, ISC provided a bibliography (SC11-SA-WP-09: ISC Shark working group and information papers on blue shark) to SC11 regarding the NP blue shark stock information, where the scientific services provider cannot conduct an appropriate review of the issue. Instead, the scientific services provider suggested that Figure 1 (NP blue shark tag recaptures) in SC12-SA-IP-16 may provide an opportunity to discuss this issue. SC12 may consider a proper process to secure enough information to undertake the work on determination of the designation of North Pacific blue shark as a northern stock. SC12-SA-IP-16 contains tagging information (Figure 1).

472. It was noted that the information paper outlined population genetics but not spatial structure analysis, so SC could not identify if the north Pacific and south Pacific blue shark are distinct stocks. The theme co-convenor commented that SC had been charged with evaluating whether North Pacific blue shark was a northern stock, and suggested that CCMs could consider drafting some language for Agenda item 4.3.4.2.

473. FFA members noted that the analysis and research recommended by ISG-1 at SC10 had not been completed so there was no new information to assist a decision about whether this species should be designated a northern stock. FFA members noted the shark expert panel's conclusion that there may be two stocks, while genetic work suggested there could be one stock in the Pacific. These CCMs noted that the tagging data analysis recommended that the equator was the most appropriate delineation line, not 20°N and the next north Pacific blue shark assessment should employ a regional split.

474. The theme co-convenor thanked FFA for presenting a potential way to progress this matter.

4.3.4.2 Provision of scientific information

Stock status and trends

475. SC12 noted that no stock assessments were conducted for these shark species in 2016. Therefore, the stock status descriptions from SC8, SC9, and SC10 are still current for oceanic whitetip shark, silky shark, and North Pacific blue shark respectively. Updated information on catches was not compiled for and reviewed by SC12.

Management advice and implications

476. SC12 noted that no management advice has been provided since SC8, SC9, and SC10 for oceanic whitetip shark, silky shark, and North Pacific blue shark, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.3.5 North Pacific shortfin mako (*Isurus oxyrinchus*)

4.3.5.1 Review of research and information

477. No stock assessment for North Pacific shortfin mako was conducted in 2016.

4.3.5.2 Provision of scientific information

Stock status and trends

478. SC12 noted that there is no existing stock assessment for North Pacific shortfin mako shark.

Management advice and implications

479. SC12 noted that no management advice has been provided for North Pacific shortfin mako shark.

4.3.6 Pacific bigeye thresher shark (*Alopias superciliosus*)

4.3.6.1 Review of research and information

480. No stock assessment for Pacific bigeye thresher shark was conducted in 2016.

481. S. Clarke noted that SC12-SA-IP-17 was available, and gave a brief summary of activities on this study which had taken place since SC11. Based on the SPC indicators paper presented at SC11 it was identified as a priority for stock assessment if funding could be found. The ABNJ Tuna Project agreed to proceed with the stock assessment and then consulted on which shark species to assess. A consultant selection process was undertaken and in January NIWA of New Zealand was awarded the bigeye thresher shark assessment contract. 12 SPC member countries' data were made available, and confidentiality agreements were put in place with USA and Japan which provided observer data. Due to the compressed timeline to produce the final report and the need for all countries to review the document, the deadline for posting this paper for SC12 was not met. Instead of a working paper, an information paper was submitted for this meeting which included the data description and methods section; the full report will be submitted as a working paper for SC13. Clarke noted that part of the motivation for undertaking the assessment was the upcoming CITES meeting where this species is proposed to be listed in Appendix II, and advised that the full assessment report would be completed this week, then the report would be reviewed by the data contributors SPC, USA and Japan and then finalized. SC was asked whether the finalized consultant's report could be made available on the Commission website and thereby made available to CITES on the basis that SC13 would review it as a working paper next year.

482. Some CCMs expressed a preference not to load the consultant's assessment report onto the WCPFC website unless and until it is endorsed by the Scientific Committee.

483. During discussions on 'other sharks' (Agenda item 4.3.5), CCMs discussed whether to add language relating to the prospect of thresher sharks being listed on CITES Appendix II at the upcoming COP17. One CCM made the point that WCPFC needed to progress on this species including the stock assessment.

4.3.6.2 Provision of scientific information

Stock status and trends

484. SC12 noted that there is no existing stock assessment for Pacific bigeye thresher shark but acknowledged the submission of SC12-SA-IP-17 which represents the initial chapters of a stock assessment currently in preparation.

485. SC12 noted that, although it was planned that the bigeye thresher shark assessment would be presented to and reviewed by SC12, the full assessment report could not be completed in time and is currently being finalized by the consultants, the WCPFC Secretariat, the SPC (on behalf of some of their members), the United States and Japan. SC12 understands that the finalized bigeye

thresher assessment report will be posted on the ABNJ Tuna Project website when ready, and then provided to SC13 for discussion.

Management advice and implications

486. SC12 noted that no management advice has been provided for Pacific bigeye thresher shark.

4.4 WCPO billfishes

4.4.1 South Pacific swordfish (*Xiphias gladius*)

4.4.1.1 Review of research and information

487. No stock assessment was conducted for South Pacific swordfish in 2016.

- a. Research on South Pacific swordfish biology – aging, growth and maturity (Project 71)

488. J. Farley presented SC12-SA-WP-11, on determining swordfish growth and maturity relevant to the southwest Pacific stock. The paper was the final report for a project co-funded by the WCPFC (Project 71). The aim of the study was to determine the degree to which differences in biological parameter estimates obtained in previous studies of swordfish in the SW Pacific and Hawaiian regions were methodological or due to spatial variation in life-history. After re-examining the sectioned anal fin spines (rays) and ovary histology from studies undertaken in Australia in the 2000s, it was found that methodological differences did exist between the previous Australian and Hawaiian studies. However, a direct comparison of age estimates from spines and otoliths found agreement up to age 7 years for females and age 4 years for males; after which otoliths tended to give much higher ages than those estimated from spines. It was noted that age estimates from otoliths were likely to be more reliable in older/larger swordfish. The otolith-based results indicate that swordfish live longer and grow slower than previously estimated. It was recommended that new growth and maturity parameters estimated from this study be included in future stock assessments for swordfish in the southwest Pacific, and that otolith-based estimates be prioritised. It was also recommend that otolith-based age estimation is investigated for other swordfish (and other billfish) stocks.

489. The theme co-convenor expressed appreciation for its contribution to Project 71, noting that it would be helpful for the next South Pacific swordfish assessment.

490. FFA members supported the six recommendations in the paper including the use of otolith-based growth and maturity estimates. These CCMs noted the last assessment's uncertainty particularly in growth estimates, making the choice of a single model to base SC advice on impossible, and noted that the potential maximum catch under CMM 2009-03 is well in excess of the MSY estimates in the last assessment. These members noted that choosing one growth schedule over the other, without strong evidence to determine which is more representative of swordfish growth in the south Pacific, had significant management implications. Project 71 addressed these concerns. FFA members recommended that the question of stock delineation separating south-western and south-central populations be taken up at the pre-assessment workshop. These CCMs sought further improvements in the provision of operational catch and effort and size composition data, tagging, and information on CPUE indices from different fleets.

491. Australia noted SC12-SA-IP-11, a timeline of fleet and management changes in Australia's tropical tuna which could be used as a template for SC members. To help facilitate discussions about the

reliability of data for various fleets and their suitability for constructing indices of stock abundance, compiling histories of management measures, fishing strategies, gears and sampling regimes for all fleets, updated as needed, could be useful. This CCM commented that without such information, SC is likely to continue to debate what changes have occurred in these fisheries and whether they are adequately accounted for in the development of related indicators. Australia proposed that SC12 recommend that each CCM develop reports for each of their fleets detailing this history and any changes as updates, and encouraged CCMs to produce similar reports. It was noted that Australia's domestic managers found such a document very useful in part to mitigate against loss of information through time through turnover of staff.

4.4.1.2 Provision of scientific information

Stock status and trends

492. SC12 noted that no stock assessment was conducted for South Pacific swordfish in 2015. Therefore, the stock status description from SC9 is still current.

Management advice and implications

493. SC12 noted that no management advice had been provided since SC9. Therefore, the advice from SC9 should be maintained.

4.4.2 Southwest Pacific striped marlin (*Kajikia audax*)

4.4.2.1 Review of research and information

494. No stock assessment for Southwest Pacific striped marlin was conducted in 2016.

4.4.2.2 Provision of scientific information

Stock status and trends

495. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

496. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.3 North Pacific striped marlin (*Kajikia audax*)

4.4.3.1 Review of research and information

497. No stock assessment for North Pacific striped marlin was conducted in 2016.

4.4.3.2 Provision of scientific information

Stock status and trends

498. SC12 noted that no stock assessments were conducted for these species in 2016. Therefore, the stock status descriptions from SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin are still current. Updated information on North Pacific striped marlin catches may be available in the ISC Plenary Report (SC12-GN-IP-02), and for South Pacific striped marlin in SC12-ST-IP-01, but was not compiled for and reviewed by SC12.

Management advice and implications

499. SC12 noted that no management advice has been provided since SC8 and SC11 for South Pacific striped marlin and North Pacific striped marlin, respectively. Therefore, previous advice should be maintained, pending a new assessment or other new information.

4.4.4 Pacific blue marlin (*Makaira nigricans*)

4.4.4.1 Review of research and information

500. A new stock assessment for Pacific blue marlin was conducted by ISC in 2016.

501. J. Brodziak, Chair of the ISC Billfish Working Group (ISC BILLWG) presented SC12-SA-WP-12 an update of the benchmark stock assessment for the Pacific blue marlin (*Makaira nigricans*) stock conducted in 2013 by the ISC Billfish Working Group (BILLWG). The 2016 assessment update consisted of applying a Stock Synthesis model with newly available catch, abundance index, and length and size composition data for 1971-2014. We used the same model structure and parameters as were used in the base case run from the 2013 stock assessment. The results indicated that biomass (age 1 and older) for the Pacific blue marlin stock fluctuated around 120,000 metric tons from 1971 until 1984, thereafter exhibited a long-term decline to the lowest level of 69,720 metric tons in 2009, and then increased to around 78,000 metric tons during the last three years of the assessment (2012-2014). Estimated fishing mortality gradually increased from the early 1970s to the mid-2000s, peaked at 0.38 year⁻¹ in 2005 in response to higher catches, and declined to 0.28 year⁻¹ in the most recent years (2012-2014). Compared to MSY-based reference points, the current spawning biomass (average for 2012-2014) was 23% above SSBMSY and the current fishing mortality (average for ages 2 and older in 2012-2014) was 14% below FMSY. The base case model indicated that under current conditions the Pacific blue marlin stock was not overfished and was not subject to overfishing relative to MSY-based reference points.

502. Australia asked why the assessment broke the Japanese fleet time series data into early and late time series, wondering about the quality of data before then and implications for uncertainty.

503. The ISC BILLWG Chair explained that there was a change in logbook reporting from 1993 a change in logbook reporting, so the series breaks in 1993/94. The two series have an overall mean square error for each series fitting to the data. Regarding data quality, it was expected that the more recent logbook period would be better, but the previous period was not considered to be poor quality.

504. Australia noted that the Hawaiian longline CPUE data was based on observer data and showed a reasonably strong decline over a ten year period and asked about the data quality of the catch series.

505. The ISC BILLWG Chair noted that catch data is very good, noting that the Japanese fleet data is collected from all over the distribution areas and the Hawaii observer data is collected from the edge of

the distribution areas. From the 1990s to the present fishers were unable to operate in the area efficiently. As the Hawaii had run up against its bigeye tuna quota and was shut down within the year in recent years, it has expanded into the north east Pacific region. The CPUE for the longline in Hawaii excluded the shallow set and only considers the deep-set sector, which has an impact on blue marlin even though it is not the target. There is a strong negative correlation between the Hawaii CPUE and other CPUEs, with one showing a decline and the other flat with some variation. The ISC BILLWG Chair commented that using the Japanese early longline data combined with the Hawaii longline and excluding other series you get an overfished stock, and directed interested CCMs to the sensitivity analyses in the assessment.

506. Australia commented that the spawning biomass trend in the last year was 35% of what it was in 1971 and asked what the depletion might have been prior to that, given the fishery was operating in the 1950s.

507. The ISC BILLWG Chair confirmed that the estimated unfished biomass is included in the paper and noted that including the large catch time series starting in 1952 gives a similar trajectory, assuming a low catch of around 1000 mt to initialise the model. It was noted that ISC ran this as an alternative model in the previous benchmark analysis. It was reported that there were diverse opinions in the working group about the quality of pre-1971 data around whether it was better to start in 1971 with a stock that had experienced fishing, or start in 1952 noting that the time series catches were not as well determined.

508. Australia suggested that for the next assessment it would be useful for the analysis to go back to 1952 using Japanese data as a sensitivity and to provide alternatives.

509. SPC (J. Hampton) expressed surprised by how well the size data, even in aggregate form, were fitted by the model and asked whether there was process error in the selectivities.

510. The ISC BILLWG Chair emphasised that they are not as good when looking at the individual fits to the standardised residuals, but on an expected value sense, the difference between observed and predicted over the entire time period, they are a good fit with flexible selectivity functions. It was noted that the Japanese longline had data above 100,000 blue marlin fish lengths, which was a huge dataset, and there had been consistency measuring blue marlin. Regarding process error in the model, the ISC BILLWG Chair noted that if there is a good estimate of life history parameters, fitting the size data could be expected.

511. FFA members expressed concern that spawning stock biomass estimates declined to their lowest level of 20,972 metric tons in 2006, and only increased slightly in 2014, and the time-series of spawning stock biomass at the beginning of the spawning cycle has continued dropping to now be only 21% of the unfished SSB in 2010–2014. These CCMs considered that the paper's conclusion that the stock is not overfished could be misleading, given that the spawning biomass is close to the LRP used for tropical tunas, and asked that their concerns over the long-term reduction in spawning biomass be reflected in advice to the Commission. They noted that any assessment of this species should be carried out by SPC as the distribution pattern of this species was Commission-wide. As it was a shared stock also caught in FFA EEZs, these CCMs stated a preference to be involved as it would require FFA members' operational data.

512. Indonesia asked if the ISC BILLWG Chair had any candidate management measures for this species.

513. The ISC BILLWG Chair noted that SC had not been asked to develop management measure for this species, but to establish its status. In the table, F20% is very similar to those used for tropical tunas but assumed value of spawning depletion may not be the same for various species. It was explained that blue marlin is a highly evolved animal, designed to grow big, fast, with high potential resilience. The

resilience estimated for striped marlin was used for this species in the stock assessment. The ISC BILLWG Chair noted that the spawning potential ratio to produce MSY was 18%, which indicates the spawning biomass can be reduced to 18% of the unfished level and be at the point of best yield. It was noted that this species was not caught much in purse-seine, but is caught as bycatch. It was valuable for recreational fishing and it was important to maintain stock sizes for that. Longline fishing mortality should not be increased and the stock should continue to be monitored.

514. Japan noted FFA's sense of urgency about this species and noted that the Commission differs from other RFMOs using BMSY as the target; WCPFC essentially requires an LRP at BMSY. This CCM agreed that the stock had declined to just above MSY, but was still above MSY; the effort should not be increased.

515. Australia reminded the meeting that MSY-based reference points depended on knowing the stock recruitment relation and the value of the steepness parameter which is often highly uncertain. Comments referencing the status of the stock against MSY-based reference points, which correspond to a relatively low level of stock depletion for blue marlin, can also be highly uncertain. The blue marlin stock assessment assumes a value of steepness of 0.87 which is quite high; whether it may be a reasonable value for blue marlin remains uncertain. This CCM noted that if the value of steepness was lower than the value assumed, the corresponding status of the stock may be below the MSY-reference points noted in the table of results for the present assessment.

516. The ISC BILLWG Chair noted that the use of steepness had been carefully considered in the assessment and update, noting that steepness is effectively a function of life history parameters, reproductive ecology, and density-dependent patterns in life history parameters that are used for stock assessment. It was also noted that research published in 1999 estimated maximum reproductive rates of some 246 fish stocks using mixed effects analyses and produced an associated estimates of steepness of about $h \approx 0.9$ for swordfish, the only billfish analysed (i.e., Myers, R. et al. 1999. The maximum reproductive rate of fish at low population sizes. *Canadian Journal of Fisheries and Aquatic Sciences* 56:2404–2419). We took an independent approach based on the simulation of populations comprised of individual fish and the calculation of how many offspring females could produce given a suite of life history parameters. The median estimate of steepness was $h = 0.87$ for North Pacific striped marlin and this value was used for Pacific blue marlin in both the 2013 and 2016 assessments. In comparison, the median estimate for Pacific bluefin tuna was about $h \approx 0.91$ (Mangel et al. 2010). There remained uncertainty about the calculation and this was characterised through the sensitivity analysis, all information relating to which is in the assessment.

517. EU noted that the current management objective set by this Commission in both the Convention and the tropical tuna CMM are bound by MSY-based management objectives.

518. SPC asked whether ISC could make the data available for others to look at, as SPC does for its assessments. The ISC BILLWG Chair suggested contacting the ISC Chair and Secretariat and the question could be considered by ISC plenary. It was noted that observers are also welcome to participate in the ISC meetings and the next ISC BILLWG meeting was set for March 2017.

519. FFA members supported the ISC conservation advice for this species, but suggested tightening the language, i.e. 'To avoid overfishing of this nearly fully exploited stock ($F/F_{MSY} = 0.88$) fishing mortality and catch rates should not be increased from the current (2012-2014) level.' These CCMs consider that the new text was consistent with SC9's advice, and reflects the average SSB from 2010–2014 which was estimated to be at 21% of unfished SSB.

4.4.4.2 Provision of scientific information

Stock status and trends

520. SC12 noted the stock status for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

Estimates of total BUM stock biomass show a long term decline. Population biomass (age-1 and older) averaged roughly 130,965 t in 1971-1975, the first 5 years of the assessment time frame, and has declined by approximately 40% to 78,082 t in 2014 (Figure 7-11). Female spawning biomass was estimated to be 24,809 t in 2014, or about 25% above SSBMSY (Table 7-3 and Table 7-4). Fishing mortality on the stock (average F, ages 2 and older) averaged roughly $F = 0.28$ during 2012-2014, or about 12% below FMSY. The estimated spawning potential ratio of the stock (SPR, the predicted spawning output at the current F as a fraction of unfished spawning output) is currently $SPR_{2012-2014} = 21\%$. Annual recruitment averaged about 897,000 recruits during 2008-2014, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates indicate a long-term decline in spawning stock biomass and suggest a fluctuating pattern without trend for recruitment (Figure 7-11).

Table 7-3. Reported catch (t) used in the stock assessment along with annual estimates of population biomass (age-1 and older, t), female spawning biomass (t), relative female spawning biomass (SSB/SSBMSY), recruitment (thousands of age-0 fish), fishing mortality (average F, ages-2 and older), relative fishing mortality (F/F_{MSY}), and spawning potential ratio of Pacific blue marlin.

Year	2008	2009	2010	2011	2012	2013	2014	Mean ¹	Min ¹	Max ¹
Reported Catch	17,828	18,282	20,086	18,165	19,407	20,727	20,356	18,232	9,160	25,589
Population Biomass	71,768	69,720	72,696	72,995	76,697	78,761	78,082	101,149	69,720	135,623
Spawning Biomass	22,706	23,065	22,392	23,182	23,432	24,771	24,809	41,717	20,972	71,807
Relative Spawning Biomass	1.14	1.16	1.13	1.17	1.18	1.25	1.25	2.10	1.06	3.62
Recruitment (age 0)	687	1031	702	1061	763	909	839	897	589	1181
Fishing Mortality	0.27	0.29	0.30	0.26	0.27	0.28	0.28	0.22	0.09	0.38
Relative Fishing Mortality	0.82	0.88	0.92	0.82	0.83	0.87	0.87	0.67	0.26	1.17
Spawning Potential Ratio	22%	21%	20%	22%	22%	21%	21%	31%	15%	51%

¹ During 1971-2014

Table 7-4. Estimates of biological reference points along with estimates of fishing mortality (F), female spawning stock biomass (SSB), recent average yield (C), and spawning potential ratio (SPR) of BUM, derived from the base case model assessment model, where “MSY” and “20%” indicate reference points based on maximum sustainable yield and a spawning potential ratio of 20%, respectively.

Reference Point	Estimate
FMSY (age 2+)	0.32
F20% (age 2+)	0.30
F2012-2014 (age 2+)	0.28
SSBMSY	19,853 mt
SSB20%	22,727 mt
SSB2014	24,809 mt
MSY	19,901 mt
C2012-2014	20,163 mt
SPRMSY	0.18
SPR2012-2014	0.21

Note: SSB values represent female spawning biomass only.

The Kobe plot depicts the stock status relative to MSY-based reference points for the base case model (Figure 7-12) and shows that spawning stock biomass decreased to roughly the MSY level in the mid-2000s, and has increased slightly in recent years (Table 7-4 and Figure 7-11). Based on the results of this 2016 stock assessment update, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing. Because Pacific blue marlin is mainly caught as bycatch, direct control of the annual catch amount through the setting of a total allowable catch may be difficult.”

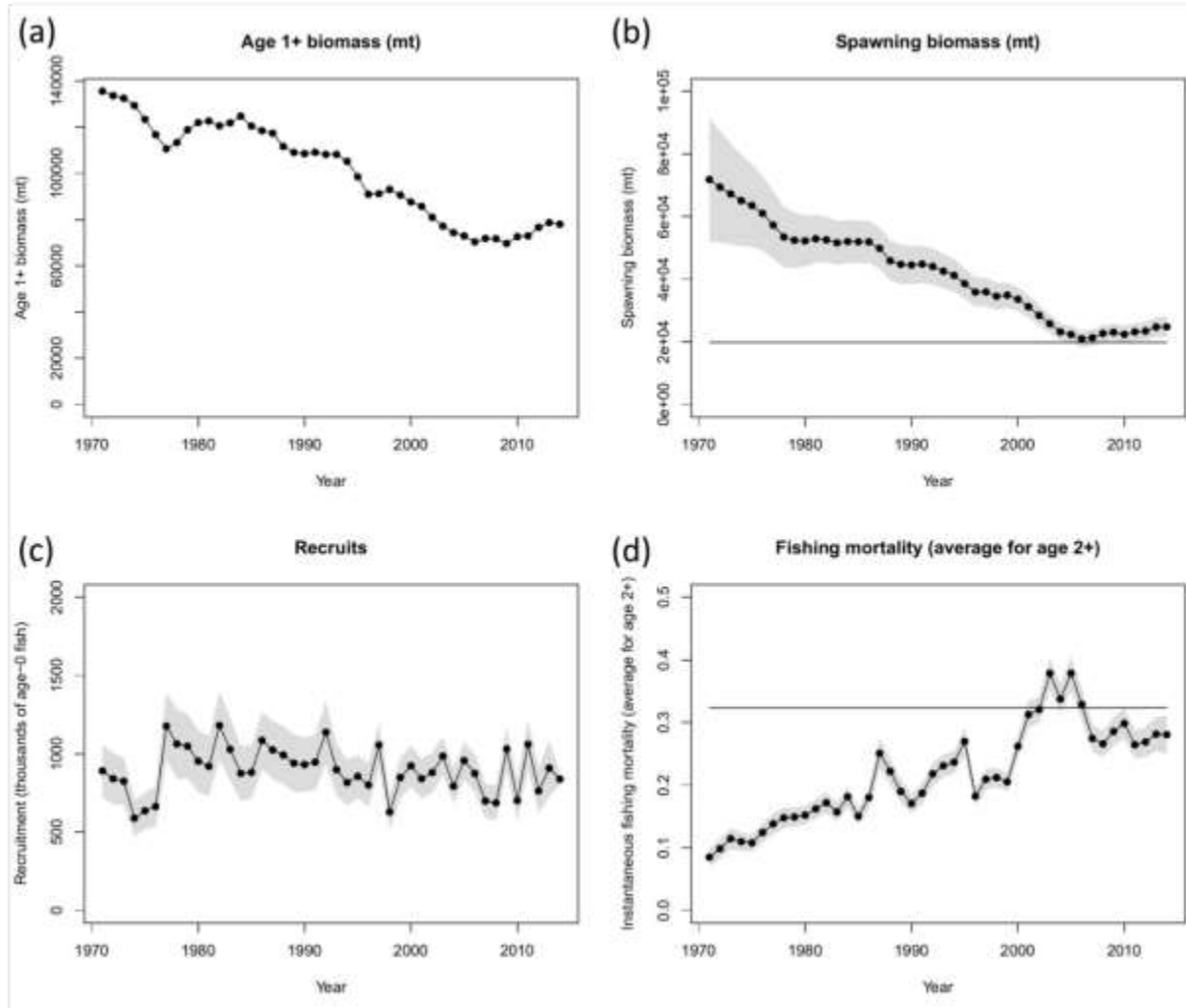


Figure 7-11. Time series of estimates of (a) population biomass (age 1+), (b) female spawning biomass, (c) recruitment (age-0 fish), and (d) instantaneous fishing mortality (average for age 2+, year-1) for BUM derived from the 2016 stock assessment update. The solid circles represents the maximum likelihood estimates by year for each quantity and the shadowed area represents the uncertainty of the estimates (± 1 standard deviation), except for the total biomass time series. The solid horizontal lines indicate the MSY- based reference points for spawning biomass and fishing mortality.

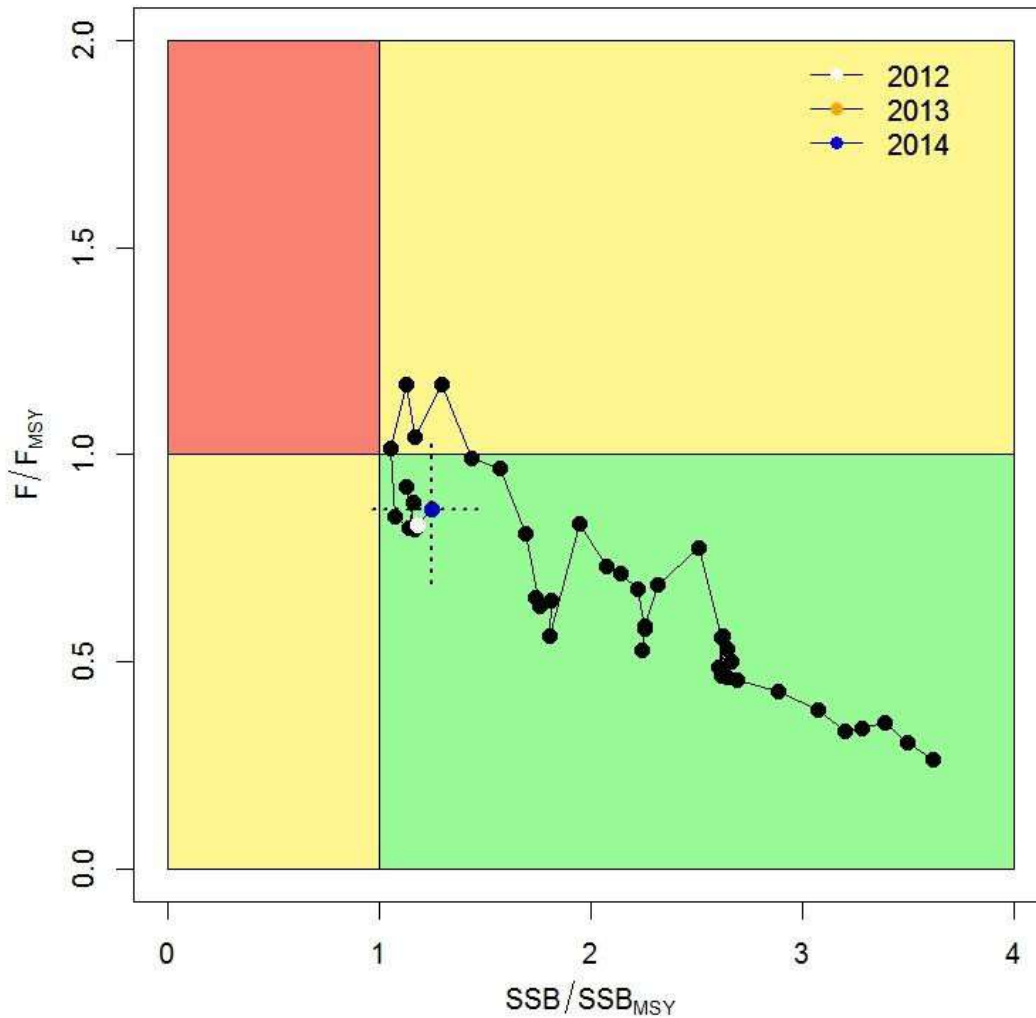


Figure 7-12. Kobe plot of the time series of estimates of relative fishing mortality (average of age 2+) and relative spawning stock biomass of BUM during 1971-2014. The dashed lines denote the 95% confidence intervals for the estimates in the year 2014.

Management advice and implications

521. SC12 noted the conservation advice for Pacific blue marlin provided by ISC in SC12-GN-IP-02 and SC12-SA-WP-12:

Since the stock is nearly full exploited, the ISC recommends that fishing mortality remain at or below current levels (2012-2014).

AGENDA ITEM 5 – MANAGEMENT ISSUES THEME

522. The Management Issues theme was convened by R. Campbell (Australia). The Theme convener informed the meeting that nine working papers would be presented during this session and that a further seven Information Papers had also been prepared.

5.1 Development of harvest strategy framework

523. The theme convener outlined a brief history of discussions at the Scientific Committees concerning the development of reference points, harvest strategies and the use of management strategy evaluation, noting that the working paper “A brief review of the use of the precautionary approach and the role of target and LRPs and Management Strategy Evaluation in the management of highly migratory fish stocks” had been presented at SC3 in 2007. SC3 recommended to the Commission that a Scoping Paper, and draft Work Plan, should be developed over the next year to help inform the SC and the Commission on the potential costs, benefits and difficulties of alternative approaches for the identification of appropriate RPs and the implementation of an MSE within the WCPO. The working paper “Approaches for identification of appropriate reference points and implementation of MSE within the WCPO” had subsequently been presented to SC4 in 2008 at which time the SC recommended that the Commission i) hold a technical workshop to progress work on reference points, and ii) establish a process for establishing key management objectives for each target species including the possibility of holding an inter-sessional workshop on management objectives in 2009. The Commission agreed that WCPFC6 should consider the possibility of holding a dedicated workshop on management objectives in 2010. A technical workshop on reference points was held jointly with SC5 (2009, Port Villa) which again supported the proposed Workshop on Management Objectives to be held in 2010. Following a restructuring of the SC meeting format, the Management Issues Theme was incorporated into the SC from SC6 in 2010.

524. In 2012 the first Management Objectives Workshop (MOW-1) was held before the Commission meeting and focused on increased the understanding of the use and application of management objectives, indicators and reference points. Preliminary discussions on management objectives for key fisheries were also held. MOW-2, held in 2013, considered a ‘Strawman’, which was a candidate list of management objectives, performance indicators and TRPs for each major fishery in the WCPFC while MOW-3, held in 2014, discussed and provided support for the development of a harvest strategy-based management framework as outlined in the harvest strategy CMM proposed by FFA and adopted by the WCPFC-11 as CMM-2014-06. MOW-4 (renamed the Harvest Strategy Workshop) was held in 2015 and reviewed MSE work undertaken by other t-RFMOs, risk levels of breaching LRPs, TRPs and HCRs for skipjack and SP albacore and an MSE work-plan. WCPFC12 agreed that there will not be a Management Objectives Workshop/Harvest Strategy Workshop in 2016, and the harvest strategy-related issues would be included on the WCPFC13 agenda in 2016. In addition, the Commission directed SC12 to include these discussions under the Management Issues theme agenda item, so that the discussion on harvest strategies, in particular, continues. WCPFC12 adopted the work-plan for the adoption of Harvest Strategies under CMM 2014-06 and tasked the SC with support from the Scientific Service Provider to undertake the activities specified in the agreed work-plan.

5.1.1 Management objectives

525. The theme convener introduced this agenda item by noting that the Commission is scheduled to ‘record’ the management objectives for each fishery or stock (SP albacore, skipjack, yellowfin and bigeye) in 2016. In particular, the WCPFC Chair, Rhea Moss-Christian, would present a ‘record’ of draft management objectives to WCPFC13 based on the “strawman” discussions at MOW2. While noting that

the adoption of management objectives was a role for the Commission, the convener noted that SC12 may provide comments for the consideration of the Commission

526. J. Annala (New Zealand) recalled his concern last year when the Commission disbanded the MOW process and handed a large part of it back to SC. Acknowledging that SC has a role to play in the harvest strategies and management procedure process, Annala observed that in CCSBT progress was not made on these issues until the Commission established the Strategy and Fishery Management Group composed of fishery managers and scientists to work on these matters.

527. The theme convenor agreed that a lot can be learned from other tuna RFMOs and noted that he had begun considering what support might be needed for the process. It was noted that establishing the objective is important because a management objective requires performance indicators and monitoring strategies, etc., all the pieces needed to fit together.

528. Japan supported these concerns and noted that it was important to have some sort of forum to get managers and stakeholders involved. This CCM noted that SPC in SC12-MI-WP-05 suggest the establishment of a working group.

529. EU strongly supported the foregoing views.

530. SC12 noted that the Commission is scheduled to ‘record’ the management objectives for each fishery or stock (south-Pacific albacore, skipjack, yellowfin and bigeye) in 2016. Noting the direct relationship between management objectives, and the need to identify performance indicators within the Management Strategy Evaluation (MSE) currently being developed, SC12 encourage WCPFC13 to provide additional clarity on the management objectives for skipjack and south-Pacific albacore.

5.1.2 Reference points

a. South Pacific albacore

531. The theme convenor noted that the Commission is scheduled to agree a TRP for South Pacific albacore in 2016 and SC12 was asked to consider providing advice on the implications of a range of TRPs for South Pacific albacore for the consideration of the Commission.

532. G. Pilling (SPC) and M. Skirtun (FFA) presented SC12-MI-WP-01, on biological and economic consequences of alternative fishery trajectories to achieving a candidate south Pacific albacore TRP. Using deterministic projections, biological and economic consequences of status quo (2013), effort and catch scenarios were examined for south Pacific albacore and southern longline fishery. Three alternative management interventions recovering the stock to a candidate TRP (TRP; 45% SBF=0) over 20 years were also examined, which specified either significant early effort reductions, larger effort reductions after 10 years, or smaller year-on-year reductions. Status quo conditions led to both stock and CPUE decline, and significantly reduced profits over the next 20 years. The stock was reduced to 32% SBF=0 with effort at 2013 levels, and to 23% SBF=0 with catch at 2013 levels. Achieving constant catch from a declining stock biomass required a more than doubling of fishing effort by 2033 and led to economic losses under all economic conditions, a 41% risk of falling below the LRP, and a risk of stock collapse. Economic performance was much improved under three effort reduction scenarios, with the early significant effort reduction generally outperforming the others. Displacement cost to vessels exiting the fishery was not included in this analysis, but are likely to strongly influence results. The three economic conditions examined provide some sensitivity around prices and costs, but remain fixed over the 20 years. Economic indicator analyses of the fishery suggest the likelihood of optimistic conditions occurring is

likely to decrease over time. Managers should consider the likelihood of good and bad economic conditions, and resulting trade-offs and risks, when selecting a robust management strategy. The choice of management scenario will also be influenced by the time horizon used by managers, and the value operators place on their investment.

533. A lengthy discussion took place relating to profitability, with Japan questioning why there was no big drop in profit from an early cut. Skirtun acknowledged that the study did not include displacement cost, focusing on those staying in the fishery. There would be an initial decline in profitability from taking the reduction early but overall the highest levels of profits were generated under this option. The decline would be expected to be greater once the displacement costs were included. Skirtun clarified that the study related to profitability not revenue. FFA clarified that if, for example, there was a 40% reduction in effort it was assumed that 40% of vessels would leave the fishery, leaving fewer but more profitable vessels with total profits generated in the fishery being higher than if, for example, no reduction in effort took place. The theme convenor clarified that how that cost could be incorporated into the analysis was not taken into account.

534. FFA members recalled their proposal at WCPFC12 for a south Pacific albacore TRP, and noted that the Participants to the Tokelau Arrangement would be again proposing the adoption of a TRP that maintains the spawning biomass at 45% of spawning biomass in the absence of fishing, addressing the major objective of returning CPUE to levels that allow the average vessel a chance of making a profit, as well as avoiding the LRP with a low level of risk. The analysis strongly suggested that the status quo was not a viable option for the southern longline fishery if it is to continue targeting albacore. These CCMs noted the paper's recommendations and proposed that the major outputs of SC12-MI-WP-01 be recorded in the advice of SC12 to WCPFC13, as follows: a. note the advice in the abstract of SC12-MI-WP-01, that status quo conditions will lead to both stock and CPUE declines and significantly reduced profits over the next 20 years, whereas economic performance was much improved under the effort reduction scenario; b. that maintaining status quo (2013) effort would reduce the spawning biomass to 32% SBF=0, with a relatively high risk of breaching the LRP, and CPUE would be reduced by a further 14% over the projection period.

535. In response to a question related to assumptions about fish prices, which had reduced significantly in recent years, SPC noted that fish prices and fuel prices were incorporated into the analysis through the different scenarios. Chinese Taipei further enquired about the reasons for not taking into account access fees in the study, which are an important cost for the longline fishery. FFA acknowledged that the study tried to determine how much profitability there might be in the fishery, not who was capturing that profitability. Incorporating access fees into the analysis would generate an index reflecting fleet rather than fishery profitability but that this additional index could be generated in future analyses.

536. Chinese Taipei asked if the level of CPUE for short-term and long-term closure has been calculated, noting that if CPUE is lower some vessels might tie up in the ports resulting reduction of effort and if CPUE is even lower the vessels would leave the fishery resulting further reduction of effort and increase of profit for the rest vessels.

537. SPC responded that due to the high fuel prices vessels tied up in some member states, so effectively certain fleets are at that level now. FFA noted that the analysis examined fishery profitability and explicitly included returns to operators required for them to reinvest in the fishery over the long term and, as such, where the profits generated were negative it would be expected that vessels would exit the fishery over time. FFA stated that it could in the future examine the catch rate required for vessels to remain operating in the short and long term under given conditions in relation to fish prices and fishing costs. FFA commented that part of the rationale for the TRP of 45% was to bring CPUE in the fishery

back to the level it was at before the recent expansion in effort, a level at which vessels could make a reasonable level of profit.

538. With thanks to WWF for supporting translation, FFA members drew participants' attention to the WWF albacore TRP briefing, which was a resource for CCMs to explain the TRP to stakeholders.

539. The theme convenor requested information on the percentage of the total profit attributable to non-albacore species.

540. As the study will be forwarded to the Commission for consideration, Chinese Taipei asked that the authors conduct similar calculations based on the years before the recent expansion in fishing effort (the last 3-5 years). This request was made because some fleets have contributed more to the decline of CPUE, and managers may like to consider how to deal with this matter in a way that is fair.

541. Pilling noted that the south Pacific albacore indicators paper discussed at this meeting includes data on effort by flag for the last ten years.

542. The theme convenor requested that the paper's authors attempt to clarify some of the issues based on discussions raised during this session to ensure the Commission receives clear advice on this matter.

543. SC12 reviewed information related to the biological and economic consequences of alternative catch trajectories to achieve a candidate south Pacific albacore target reference point (SC12-MI-WP-01) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the biological and economic consequences of the various trajectory options modelled in this paper in making a decision on an appropriate target reference point for south Pacific albacore. In particular, SC12 draws the attention of WCPFC13 to the importance of assumptions on key bycatch species catch levels for economic estimates; and the need to include additional economic losses due to the exit of vessels from the fishery.

b. Bigeye tuna

544. The theme convenor noted that in 2016 the Commission is scheduled to agree timeframes to rebuild bigeye to the LRP, and SC has been requested to provide advice on determining a biologically reasonable timeframe for rebuilding bigeye tuna to [or above] its LRP.

545. G. Pilling presented SC12-MI-WP-02, on biologically-reasonable rebuilding timeframes for bigeye tuna. Biologically reasonable timeframes can be specified in terms of stock generation time (the generation time for bigeye in the WCPO is estimated to be around 4 years), or the time the stock would need to rebuild in the absence of fishing (reaching the minimum rebuilding level (the LRP) took 2 years, and up to 4 years for the higher rebuilding levels) A number of alternative example timeframes were considered to rebuild the stock based on identified example national and regional management policies. The ability of a management scenario to achieve rebuilding within those specified timeframes depended upon the rebuilding level selected. These were examined using stochastic projection analyses for the bigeye stock. Future recruitment was determined by randomly sampling from the 2002-2011 recruitment deviations from the stock-recruitment relationship. Examined rebuilding levels were defined based upon the adopted LRP for bigeye tuna, and minimum stock levels consistent with four levels of risk (5, 10, 15 and 20%) of the stock falling below that LRP. Five management scenarios were examined: status quo (2012); a fishery 'closure'; and three scenarios developed within the 2015 evaluation of CMM 2014-01 to encapsulate CMM implementation uncertainty. All scenarios were compatible with rebuilding to the LRP within the timeframes, but the status quo and 'pessimistic' scenarios (that had smaller reductions in

fishing) failed to meet the rebuilding timeframe if a rebuilding level consistent with lower levels of risk (5-20%) was selected. For timescales based upon the absence of fishing, however, by definition only the 'closure' scenario was consistent

546. Regarding the rebuilding level, Japan wondered how the candidate rebuilding target levels (some of which differed by only 1%) was practically meaningful, considering the uncertainty of the assessment. Regarding the 2015 choices management scenario, this CCM commented that there appeared to be some unusual things happening that year in fisheries, and suggested that when the paper is presented to Commission it should include status quo (2012) and 2015 choices.

547. SPC agreed that it would be harder to differentiate successful rebuilding to targets that were only different by 1%. Regarding the 2015 choices scenario, that reflected SPC's understanding of choices CCMs made for their fleets as allowed within the tropical tuna CMM, for the 2015 fishing year. Those choices defined future levels of catch and effort within tropical purse seine and longline fishery used within the CMM evaluations, rather than actual levels of fishing within the year 2015.

548. USA noted that SC12-MI-WP-02 touched on a number of important choices for WCPFC regarding the implementation of a stock rebuilding plan for bigeye tuna. The choices of rebuilding time frame, rebuilding target, probability of achieving the rebuilding target within the rebuilding time frame, and the set of future fishing mortality rates by fleet to achieve the target are linked and should be jointly considered in the development of a viable rebuilding plan. Not considered in the paper but also important are the effects of implementation uncertainty on the probable success of the plan. This CCM commented on some transparency issues in the paper: the rebuilding analyses may be difficult to reproduce because there is no self-contained documentation of the bigeye tuna life history parameters used in the calculations and assumptions about the fishery system dynamics including the distribution of future fishing effort and fishery selectivities by the various fleets that impact bigeye tuna; this CCM suggested a clear tabulation of assumed parameter values and other related assumptions. This CCM commented that the use of a definition of mean generation time (Berger et al., 2013) that depends on an assumption of von Bertalanffy growth parameters and an associated optimum length (L_{opt}) parameter is not clear – the standard definition of mean generation time is 'the mean age at which members of a cohort are expected to reproduce (denoted by T); this is not the same as 'the mean age that optimizes egg production assuming a von Bertalanffy growth curve (denoted by G in the WP)', used in SC12-MI-WP-02, with the distinction being the concept of mean generation time does not require the assumption that expected fish growth follows a von Bertalanffy (VB) growth curve. USA noted that this distinction may be important if the actual growth pattern does not conform to a VB growth curve. In this context, USA noted that the 2014 assessment of WCPO bigeye tuna does not use a fitted VB growth curve for all age classes and that the mean size at age for the first 8 quarterly age classes are estimated as free parameters (Harley et al. 2014) and that this affects the value of t_0 . This CCM further noted that the length at maximal age parameter in the 2014 bigeye assessment (L_2 , length at an age of 40 quarters) is not estimated but instead is fixed at the value of $L_2=184$ cm. As a result, the 2014 treatment of bigeye growth does not seem to conform to a VB growth model with estimated VB parameters of L_{inf} , K, and t_0 . Given this, it is not clear that the calculation of G is consistent with the required assumptions. It was also noted that it is not clear how the age-specific values of adult natural mortality were used to calculate L_{opt} . USA emphasized that the use of the random resampling of the 2002-2011 recruitment deviations to simulate future recruitment values is ecologically optimistic, noting that during 2002-2011, recruitment strengths for bigeye exceeded the long-term average recruitment level for assessment time period, as noted in the working paper. This CCM considered it important to account for the possibility that future recruitment patterns of bigeye tuna may not be above average, suggesting that alternative scenarios of recruitment strength based on the empirical time series of recruitment estimates should be developed and analyzed to provide managers with a fuller range of future outcomes. The USA also pointed out that two other uncertainties in the rebuilding stock projections are not accounted for in the working paper -- process errors for biological and fishery

parameters, such as growth and fishery selectivity, and estimation errors in the initial population size at age estimates at the beginning of the projection time period. It was noted that including both sources of uncertainty would provide a more realistic characterization of the set of probable stock rebuilding trajectories through time, noting that the working paper's current treatment only accounts for future variability in recruitment.

549. SPC asked SC12 for clarification about assumptions for future bigeye recruitment within projections, noting that SC had previously made a decision that recent recruitment patterns (in the case of bigeye tuna) would be assumed to continue into the future.

550. Japan observed that a couple of years ago, SC agreed to use recent recruitment assumptions and this could continue. However, Japan requested more information for the managers in the form of a sensitivity analysis assuming alternative (lower) recruitment levels, because if there was some impact on recruitment it would be informative for the managers to have analysis based on a lower historical average.

551. FFA members noted that in 2016 the Commission is scheduled to agree timeframes to rebuild the bigeye stock to the LRP of 20% of unfished spawning biomass and noted that the latest stock assessment estimates the bigeye spawning biomass to be around 16% of SBF=0, and that the level of biomass to achieve biological MSY is just over 21% of SBF=0. These CCMs noted that the contribution to bigeye mortality by longline and purse-seine fisheries was approximately equal, making the rebuilding target something to be addressed equally by all fisheries. These CCMs opined that the analysis provided by SPC in the working paper provides practical advice for decision-making; a time-frame of 8-10 years, assuming recruitment remains above average, is both achievable and in line with rebuilding timeframes adopted by several CCMs in domestic legislation. To rebuild beyond the LRP to account for acceptable levels of risk, or to shorten the timeframe, would require aspects of the tropical tuna CMM to be tightened considerably and some options removed. These CCMs took the view that the Commission must operate under the assumption that all CCMs will choose their least painful option and that this weakens the measure's effect, and commented that SPC's 'optimistic' scenario must be an actual scenario. FFA members suggested that SC12 advise WCPFC13 that an 8-10 year timeframe for the bigeye stock to be rebuilt to the LRP is achievable and may be adopted for the development of a harvest strategy and WCPFC13 should strengthen the tropical tuna CMM if managers wish to build the biomass further and thus make allowance for a reasonable level of risk of not breaching the LRP in future.

552. The theme convener commented that SPC would take these comments on board and revise the paper before forwarding them to the Commission. Results based on the different recruitment scenarios could be put in an appendix, and information on the potential for implementation error associated with any rebuilding plan could be included within the paper. The theme convener also noted that while the SC should take note of the options included in the paper presented, the SC was not required to make a decision on which particular option should be preferred as this was a management decision.

553. SC12 reviewed information related to biologically reasonable rebuilding timeframes for bigeye tuna (SC12-MI-WP-02) and provided a number of suggestions to clarify aspects of the paper before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the various options modelled in this paper in making a decision on an appropriate rebuilding timeframe for bigeye tuna. In particular, SC12 draws the attention of WCPFC13 to i) the estimated bigeye generation time of 4 years, and minimum rebuilding time in the absence of fishing of 2-4 years, ii) that consideration of acceptable risk for the bigeye stock falling below the limit reference point will influence the findings, and iii) it will be important to examine not only the timeframe but also the stock trajectory of rebuilding.

5.1.3 Implications of alternative levels of acceptable risk

554. The theme convenor noted that the Commission is scheduled in 2016 to agree the levels of risk for the four key tuna species in 2016 (south Pacific albacore, skipjack, yellowfin and bigeye tuna). No specific advice has been requested by the Commission, but SC12 may review information (including a summary of previous work and the requirements of the ongoing Management Strategy Evaluation work) and provide comments and/or recommendations for the consideration of the Commission.

555. J. Larcombe (Australia) presented SC12-MI-WP-03, a proposal for adopting acceptable levels of risk for breaching LRPs of four key tuna species in the WCPO. In 2015, WCPFC12 adopted a work plan to develop harvest strategies for the management of key tuna species according to CMM 2014-06. Under this work plan, the Commission is tasked in 2016 with agreeing acceptable levels of risk for breaching the agreed LRPs of the key tuna species. The Scientific Committee have previously provided substantial technical and scientific advice to inform a decision on risk levels. However, given the range of fishery objectives, as well as potential economic and social consequences, this has been identified as a management decision for the Commission. The following interim acceptable levels of risk for breaching LRPs are proposed for four of the key tuna stocks in the WCPO – 5% for South Pacific albacore, 5% for skipjack tuna, 10% for yellowfin tuna and 10% for bigeye tuna. A rationale for these proposed risk levels is provided which makes reference to: the requirement to adopt risk levels that are very low (CMM 2014-06; Annex II of the UN Fish Stocks Agreement); the social and economic consequences of depleted key tuna stocks; the biological consequences of depleted key tuna stocks; the need for separation of limits from agreed or potential TRPs. The risk levels are proposed as ‘interim’ because they may be revisited as more information becomes available through the management strategy evaluation process.

556. The theme convenor noted that the four rationales in the working paper provided a good framework for discussion of this issue.

557. With WCPFC13 due to make a decision on acceptable levels of risk for breaching the LRP for four key tuna species, FFA members suggested that SC endorse the recommendations in SC12-MI-WP-03. These CCMs noted that they will be presenting a similar proposal to WCPFC13, and welcomed feedback from other CCMs to improve it.

558. A lengthy discussion took place about the process for determining risk level by species (5% for skipjack and albacore tuna; 10% for bigeye and yellowfin tuna).

559. Larcombe explained that this has been difficult to resolve, noting that managers are required to think about the consequences of breaching the LRP, and how important it is to avoid those consequences informs the decision on an appropriate risk level that it is ‘very low’. FFA members have considered the overall management objectives and how these would not be achieved if a stock falls below the limit reference point. This consideration of consequences resulted in a lower risk tolerance for two of the stocks. Each nation may undertake its own consideration process.

560. Japan commented that it was difficult to have a technical and scientific consideration of the proposal as the rationales were not strictly scientific. This CCM noted the WCPFC’s LRP was higher than most domestic LRPs and opined that the discussion about risk should be separated from a discussion about the target level; focusing on risk was a step ahead and risked losing focus on the state of the stocks.

561. Australia noted that there was a clear relationship between the limit, the target and the risk level and this was outlined in CMM 2014-16.

562. USA noted that for the WCPFC species the LRPs are rather conservative and can have a higher level of risk.

563. EU suggested adding a table to the paper providing examples from other relevant fora including RFMOs and, where specific numbers were available, providing some insight into the supporting science. Noting that WCPFC established a single LRP across all the tropical tunas despite differences in biological features of the species concerned, EU wondered about making the risk level the same for them all.

564. Some CCMs commented that SC's role was to propose LRPs but not to decide the risk level of breaching those LRPs; that this was a management decision. However, SC could endorse a framework within which the managers could do that.

565. Larcombe thanked EU and others for their constructive comments and committed to addressing these in the proposal going to the Commission.

566. One CCM asked how biological perspectives were included in the determinations, opining that albacore and skipjack tuna could withstand heavier exploitation levels and rebound quicker than bigeye and yellowfin tuna, but their risk levels were proposed to be 5% for albacore tuna compared with 10% for bigeye and yellowfin tuna.

567. USA commented on resilience and natural mortality rates, noting that stocks with a higher natural mortality rate like skipjack tuna have a lower stock recruitment resilience to fishing and therefore the ability of the stock to replenish itself. It was a misconception that small pelagic stocks have more resilience. This CCM commented that skipjack tuna accordingly needed a bigger buffer than bigeye.

568. Japan queried the reasoning behind the 20% of unfished stock LRP recommendation; it appeared to not be based on species-specific science but in part on numbers used in other organisations.

569. Larcombe clarified that four rationale areas were considered and only one of them related directly to the biology of the species. The differing risk levels in the proposal related to the consequence for FFA members and their communities of breaching the LRP.

570. SC12 reviewed a proposal for adopting interim acceptable levels of risk for breaching limit reference points in the WCPO (SC12-MI-WP-03) and provided a number of suggestions to clarify aspects of the rationale within the paper before a revised version is forwarded to WCPFC13. Noting that WCPFC13 is scheduled to agree levels of risk for the four key tuna species, SC12 recommended that WCPFC13 take into consideration the rationale outlined in this paper for identifying acceptable levels of risk and again notes that the UN Fish Stocks Agreement states that the risk of exceeding LRPs should be very low. SC12 also recommends that adopted risk levels be seen as interim and be reviewed in light of the outcomes of the Management Strategy Evaluation work-plan. SC12 recommended that WCPFC13 notes that levels of risk for breaching LRP should be considered coupled with the corresponding conservative or liberal nature of the LRP. For example, the bigeye tuna LRP (20% of unfished spawning biomass) is very close to the depletion expected to occur (0.21) if the fishery attained the spawning biomass at MSY. Therefore the bigeye tuna LRP is viewed as conservative and could have associated higher levels of risk for breaching the LRP.

5.1.4 Performance indicators

571. This agenda item was discussed in combination with Agenda item 5.1.5.

5.1.5 Monitoring strategy

572. The theme convenor informed the meeting that the Commission has tasked SC12 with providing advice on a range of performance indicators to evaluate the performance of HCRs, together with monitoring strategies to assess performance against reference points, for both South Pacific albacore and skipjack. He noted that performance indicators and monitoring strategies are linked and as such these two issues will be discussed together

573. R. Scott presented SC12-MI-WP-04, on performance statistics and monitoring strategies for skipjack and South Pacific albacore commensurate with candidate management objectives for the Tropical Purse Seine and Southern Longline Fisheries. The report of the second WCPFC Management Objectives Workshop (WCPFC10-2013-15b 'straw person') provides a candidate list of management objectives for WCPO fisheries, including those for the tropical purse seine and southern longline fisheries. SC12 was requested to develop advice on a monitoring strategy to assess performance against reference points and management objectives; and a range of performance statistics to evaluate the performance of candidate HCRs for WCPO skipjack and South Pacific Albacore. SC12-MI-WP04 identifies potential performance statistics and monitoring strategies based on the information presented in WCPFC10-2013-15b but additionally takes into account recent experience of analyses to evaluate candidate HCRs for skipjack (SC12-MI-WP06) and recent discussions on an MSE framework for WCPFC (SC12-MI-WP05). Noting that the ultimate choice of performance statistics and monitoring strategies will be dependent on the decisions of managers on their objectives for the fishery

574. The theme convenor noted that for south Pacific albacore and skipjack, the Commission tasked SC12 with providing advice on a monitoring strategy to assess performance against reference points, and noted that the monitoring requires collection of a lot of data and was highly dependent on the fishery objectives, which the Commission has not yet decided. It was noted that as the Commission proceeds through the MSE process and builds the operating model, the components in the model will need to satisfy the performance indicators and management strategies. Currently, there was a straw man objective.

575. FFA members raised the issue of changes in terminology in the paper, and asked that in developing the harvest strategy approach CCMs, SPC, ISC and expert advisors be aware of the importance of simple, consistent and concise terminology; new terms should be avoided, and the more familiar terminology from the MOW process preferentially used. The commonly understood term "performance indicator" should continue to denote a measurement (either quantitative or qualitative) or modelled statistic used to evaluate current or future performance. These CCMs also noted the need for simplicity and clarity in the way these issues are communicated to the Commission.

576. EU took the view that this was a further indication that SC should remind the Commission of the usefulness of reactivating the MOW process.

577. FFA members had some suggestions for further refining the candidate list of performance indicators proposed in the working paper, namely: that appropriate measures of effort creep be captured in the refinement of the list for both the purse-seine and longline fisheries; that performance indicators related to contribution to GDP, percentage of total catch processed by SIDS, and value of product exported from SIDS are also added to the southern longline fishery candidate list; and the process to select performance indicators includes consideration of the resources and costs associated with the collection of data needed to allow those indicators to be measured and modelled. FFA members commented that further detail on how the performance indicators would be measured, modelled and used for the management of the fishery had to be determined in order to develop a comprehensive monitoring strategy for each fishery.

578. Scott noted for both of these questions that each performance indicator will need to be considered in its own right; some will need to be monitored over a long time period and some of the metrics will have a degree of variation and sometimes within that there is autocorrelation so it can be misleading. It was noted that if a performance indicator is adult biomass relative to the reference point, that can only be monitored when the stock assessments are undertaken, which is 3 or 5 years, depending on the species.

579. It was noted that F-based indicators should be included in the list of indicators in the paper. The theme convenor also noted that it may be possible for some CCMs to track fishery performance against several of the economic indicators on an annual basis using domestic data, but biological indicators would need to be associated with stock assessments which are scheduled to be undertaken every three years.

580. SC12 reviewed candidate performance indicators and monitoring strategies for skipjack and South Pacific albacore commensurate with candidate management objectives for the tropical purse seine and southern longline fisheries (SC12-MI-WP-04) and provided a number of suggestions to clarify aspects of the paper and expand on the list of performance indicators before a revised version is forwarded to WCPFC13. SC12 recommends that WCPFC13 note the candidate performance indicators and monitoring strategies listed in this paper, and noting that the number of key performance indicators should be kept to a tractable level, provide advice on what performance indicators and monitoring strategies should be included for the development of harvest strategies under CMM 2014-06.

5.1.6 Harvest control rules and management strategy evaluation

581. The theme convenor noted that for South Pacific albacore and skipjack, the development of HCRs and management strategy evaluation frameworks is scheduled to commence in 2016 and continue through until 2018. SC12 had been requested to review progress and information on the development of HCRs and management strategy evaluation and if necessary make recommendations for the consideration of the Commission. In particular, SC12 was asked to review the report of the expert consultation held at SPC in June on the development of a management strategy evaluation framework for WCPFC tuna stocks and make recommendations as appropriate to the Commission.

582. Management Strategy Evaluation workshop

583. J. Annala (New Zealand) presented SC12-MI-WP-05, the report of the Expert Consultation Workshop on Management Strategy Evaluation. The Western and Central Pacific Fisheries Commission (WCPFC) is developing a harvest strategy framework for the management of skipjack, bigeye, yellowfin, South Pacific albacore, Pacific bluefin and North Pacific albacore. As part of this process it is proposed to test the performance of candidate HCRs using management strategy evaluation (MSE). In order to plan the work ahead and to prioritise the issues that will need to be addressed, WCPFC funded an expert consultation workshop made up of practitioners in MSE from a range of fisheries fora. SC12-MI-WP-05 outlines the workshop recommendations on the general aspects of developing an MSE framework as well as specific recommendations for WCPO skipjack and South Pacific albacore. In addition, it notes the workshop considerations for the necessary future requirements for technical working groups and stakeholder consultation meetings that will be necessary to implement the MSE approach.

584. The theme convenor commented that this was a very large project of work for SPC, and consideration would need to be given for the support of it when discussing the work plan.

585. Japan noted the technical expertise involved in the workshop and commented that this difficult work was coming to SC for the first time and would then go Commissioners, who would determine the

actual harvest strategies. Starting with basic concepts would be important to educate the Commission on MSE. This CCM asked who would be doing the MSE work and how it would be funded.

586. The theme convenor confirmed that the Commission would be funding SPC to do the technical work to development the operational model and undertake the evaluation of harvest strategies but that there would be a need for additional funding to support aspects of this work.

587. In response to a query from Japan about the panel's recommended approach to use either an empirical or model-based approach for skipjack tuna due to concerns about the continued availability of data, the theme convenor clarified that the expert workshop supported the model-based assessment for skipjack tuna though the concerns about continued data availability would need to be addressed.

588. The theme convenor suggested SC endorse the expert workshop report including scope of work.

589. FFA members noted the need to determine the period over which HCRs are to be implemented, evaluate which candidate HCR is likely to be most effective in achieving management objectives, and noted that the timeframe for management intervention was a central consideration.

590. Indonesia strongly supported the efforts to develop harvest strategies, noting that skipjack tuna was an important species for Indonesia. Indonesia was starting to develop harvest strategies for skipjack tuna in its archipelagic waters and appreciated how complicated it is to implement harvest strategies; one primary difficulty was availability of data, which affects the model developed. However, Indonesia opined that this was not a reason to delay the development of harvest strategies; best available data should be used. This CCM asked for clarification about the process for moving ahead.

591. Scott commented that the next stage was to develop the operating model and begin conditioning it to the data, uncertainties, and the plausible alternative states of nature to be considered to test some of the HCRs. The creation of the modelling framework included a consultative process where input from stakeholders would be sought to determine what it should include.

592. PNA members supported the FFA position that MSE discussions need to be integrated into the existing work of the SC, TCC and the Commission without requiring additional subsidiary bodies or meetings, and supported the Commission's work on harvest strategies and workplan on the same basis. These CCMs could not support the establishment of two new MSE working groups as recommended, but could discuss alternative arrangements for achieving the stated objectives.

593. RMI supported other PNA and FFA members in the view that the MSE process should be an integral part of SC, TCC and Commission processes, in which all CCMs participate, especially SIDS as the resource owners.

594. It was agreed to continue discussions about how best to facilitate support meetings for the MSE work-plan in an ISG. The theme convenor emphasised while concerns about continuing the MOW process had been noted, that hopefully all options would be open for discussion. Ultimately, the issue was about finding the appropriate means of supporting SPC to get the work done.

595. SC12 reviewed the report of the expert consultation held at SPC in June 2016 on the development of a management strategy evaluation framework for WCPFC tuna stocks (SC12-MI-WP-05). SC12 endorsed the scope of the work to be undertaken as outlined in this report and recommended that i) while a model-based management strategy may be appropriate for skipjack, the concern of the workshop was on the future availability of abundance indices and tagging data for skipjack and WCPFC13 should consider how these necessary data can continue to be provided

to support the assessment and MSE, and ii) that both empirical and model-based management strategies could be tested for South Pacific albacore but that CPUE based methods may be dependent on access to operational longline logbook data.

596. SC12 also recommended that WCPFC13 support the recommendation of the MSE workshop for the continued involvement of experts to provide technical advice on the MSE work as well as a process for ongoing science and management dialogue to facilitate stakeholder involvement in the development of harvest strategies. The SC12 considers both of these additional processes are essential for completion of the harvest strategies work-plan under CMM 2014-06, with separate consideration required for each of the species included in this work-plan. SC12 recommends that expert technical advice to the Scientific Service Provider be facilitated via informal meetings and/or workshops similar to the arrangements for the annual Pre-Assessment Workshop. With respect to science and management dialogue, SC12 recommended that stakeholder involvement should be undertaken via in-country stakeholder engagement with the Scientific Service Provider together with a higher-level meeting or workshop for broader stakeholder engagement (to be held as needed) to finalise input to the MSE analyses (e.g. performance indicators and harvest control rules) as well as subsequent refinements and feedback based on preliminary and ongoing results. WCPFC13 is encouraged to explore mechanisms and options for facilitating and funding these arrangements.

597. SC12 reviewed an evaluation of candidate harvest control rules for the tropical skipjack purse seine fishery (SC12-MI-WP-06). SC12 recommends that WCPFC13 note i) the utility of the approach taken for evaluating harvest control rules, ii) the associated need to develop appropriate performance indicators to adequately track effort creep in this and other fisheries in the WCPO, and iii) the need to identify an appropriate time-frame for evaluating the effectiveness of a harvest control rule.

598. SC12 was informed about the work undertaken by the Northern Committee and the ISC on the development of harvest control rules and Management Strategy Evaluation for Pacific bluefin and North Pacific albacore stocks (SC12-MI-WP-07). SC12 recommends that WCPFC13 note these developments and consider the need to facilitate discussion on Management Strategy Evaluation between those groups undertaking such work within the WCPO (i.e. the Scientific Service Provider and ISC) and across all t-RFMOs.

Candidate skipjack tuna harvest control rules

599. R. Scott (SPC) presented SC12-MI-WP-06, an evaluation of candidate HCRs for the tropical skipjack purse seine fishery. PNA members requested that SPC evaluate a number of candidate HCRs for the tropical purse seine fishery for skipjack. SC12-MI-WP06 presents the results of preliminary analyses to evaluate those HCRs. Specifically it outlines the 4 candidate HCRs that were proposed for evaluation; it details the preliminary analyses undertaken to assess their performance; it discusses the further work required for more comprehensive testing; and it identifies some potential performance indicators to determine the relative performance of the HCRs in achieving the management objectives. Two effort creep scenarios were considered for the evaluations (zero effort creep and 2% effort creep). Greater performance differences were apparent for the 2% effort creep scenario revealing a trade-off between maintaining adult biomass at the TRP and maintaining stability in effort in both the short- and longer-term.

600. Japan noted that, under the HCR, effort declined to zero at 20% SBF=0 and asked if zero effort, implying a skipjack fishery closure, could realistically be achieved. In addition, this CCM commented

that the inclusion of effort creep was useful but asked SPC to look again at the performance indicators, which looked complex and some were redundant.

601. SPC confirmed that zero effort at 20% SBF=0 was how the HCR was designed, but noted that effort control under the HCR applied only to the tropical purse seine fishery and that, throughout the evaluations, effort for other fisheries had been assumed to remain constant at 2014 levels. SPC further noted that throughout the simulation period the stock never declined below the 20% SBF=0 level. SPC commented that if the possibility of a fishery closure was not practical then a reformulation of the HCR would need to be considered.

602. PNA members were interested in the usefulness of the range of performance indicators and value, in the short to medium term, of some form of catch cap to respond to the kind of changes in fishing conditions that had been seen in the previous few years.

603. FFA members highlighted the need to understand effort creep, especially but not only in the purse-seine fishery, in order to develop appropriate management and development of performance indicators and research plans should be developed with the need to understand effort creep in mind.

604. EU proposed that CCMs consult other interested parties when they consider working with SPC so there is an opportunity to engage on developing the TORs of the work, as for example for shaping the HCRs or testing the indicators.

605. The theme convenor confirmed that this is what is being proposed regarding the MSE work. The theme convenor drew participants' attention to two information papers related to this agenda item: SC12-MI-IP-01: Preliminary evaluation of catch-based HCRs for South Pacific albacore tuna and SC12-MI-IP-04: Approaches used to undertake management projections of WCPO tuna stocks based upon MULTIFAN-CL stock assessments.

5.1.7 Harvest control rules and management strategy evaluation for northern stocks

606. The theme convenor noted that under CMM-2014-06, NC is responsible for developing a schedule of actions to adopt harvest strategies for Pacific bluefin and north Pacific albacore. SC12 was informed of the work that ISC and NC are undertaking on the development of harvest strategies and MSE testing, including a MSE Workshop ISC held in Japan in May 2016.

607. [YS](#). Akatsuka (Japan) reported the development of reference points and harvest control rules for Pacific bluefin and north Pacific albacore at NC. H. Kiyofuji (Japan) presented SC12-MI-WP-07, on recent ISC activities on MSE including introduction of MSE process, timelines to date and next steps. Two workshops sponsored by the ISC and Japan were held in 2015 and 2016. The ISC NPALBWG is leading an initial engagement process with managers and stakeholders to identify management objectives, performance criteria and other matters. The ISC ALBWG Chair will lead discussions on the 2nd ISC MSE workshop outputs (on objectives and performance measures) at NC12.

608. FFA members requested that comprehensive updates be provided on the development of all harvest strategy components for northern stocks.

609. In response to an enquiry from EU about the timeframe for developing reference points and HCRs for Pacific bluefin tuna, Akatsuka confirmed that under the CMM for Pacific bluefin this work was taking place over 2015 and 2016.

610. The theme convenor noted that NC ISC chair, Gerard Dinardo, had indicated that ISC was keen to keep abreast of the MSE work being undertaken within WCPFC and work jointly and more broadly within other tuna-RFMOs and that ways of facilitating this could be included in the discussions of the ISG mentioned above. The ISG would discuss how to facilitate the work of SPC and NC during SC12.

5.2 Limit reference points for WCPFC sharks

5.2.1 Identifying appropriate limit reference points for elasmobranchs for the WCPFC

611. The theme convenor noted that WCPFC12 had endorsed SC11's request of USD\$25,000 for the development of LRPs for elasmobranchs and had now tasked SC12 to develop a scope of work to progress this project. SC12 was also invited to consider in general appropriate management options for shark stocks. It was noted that no working papers would be presented under this agenda item, but noted that this continuing work on LRPs for sharks was based on the working paper presented to SC10 two years ago (SC10-MI-WP-07, Development of LRPs for elasmobranchs) and the report of the Pacific shark life history Expert Panel Workshop (SC11-EB-IP-13) which had been provided to SC11 last year.

612. In the absence of a TOR or scope for the work, EU asked that the agenda item remain open to be discussed in the margins with a view to developing a TOR or scope by the end of the meeting.

613. The theme convenor noted that an ISG would discuss this agenda item, including the scoping proposal.

614. FFA members stated that the priority should be improving data and bedding down stock assessment methodology for these data poor species and commented that maintaining stocks of non-target species above the level where their reproduction is seriously threatened is the required starting point for candidate LRPs for non-target stocks. While LRPs are developed, FFA members recommended the use of mitigation measures to reduce shark interactions, and the implementation of handling guidelines across all fleets to help ensure significantly shark populations are given the opportunity to recover.

615. USA commented that the project had not been scoped but a budget had been secured. With a scope of work the Commission could have advertised it right away for work to get underway. This CCM suggested that in developing a scope of work on LRPs for elasmobranchs, developing one good example may be useful, and a candidate might be the north Pacific blue shark, which was numerous and well-studied. SC had received information through a stock assessment and modelling approach, and the project could focus on investigating resilience for that species.

616. EU agreed that a better process would be to scope work then have it agreed at the Commission with a budget attached, but suggested SC take the opportunity presented and scope a project. These and other issues were discussed in the margins of SC12.

617. Based on a request from WCPFC12, SC12 developed a scope of work to progress development of limit reference points for sharks within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). The adopted scope of work for this project is in Attachment F. WCPFC13 is requested to note the development of this project scope.

5.3 Implementation of CMM 2015-01

5.3.1 Yellowfin tuna catch limit

618. The theme convener noted that SC10 had recommended that the catch of WCPO yellowfin tuna should not be increased from 2012 levels, which exceeded MSY, and measures should be implemented to maintain current spawning biomass levels until the Commission can agree on an appropriate TRP. It was also noted that according to Paragraphs 28 and 43 of CMM 2015-01, SC12 should provide recommendations for the Commission's formulation and adoption of yellowfin tuna catch limits in December 2016. In this regard, SC12 was invited to consider relevant issues including setting catch limits, identifying species composition, real-time catch reporting and provide comments/recommendations on how to further develop catch limit options to the Commission. No working papers were listed for presentation against this agenda item, however the theme convenor drew SC's attention to SC12-MI-IP-05, tables of yellowfin catch by gear and flag, 2010-2015 and SC11 paper miwp09.the working paper (SC11-MI-WP-09: An impact of purse seine fishery for yellowfin tuna stock) which had been presented to SC11 and the related recommendation made by SC11.

619. FFA members expressed concern at the dramatic increase in yellowfin reported in the "other" fisheries category, particularly in the Indonesian and Philippines handline fisheries. Noting that there is a limited understanding of these significant fisheries, FFA requested that these CCMs continue to improve data collection and provide additional information to the Commission on the management tools being used in these fisheries. Noting that CMM 2015-01 expires in December 2017, FFA members looked forward to the adoption of a more comprehensive and strategic harvest strategy approach to managing yellowfin across the stock, rather than the piecemeal approach of the current CMM. These CCMs asked that the bridging tropical tuna CMM incorporate any elements of the harvest strategy already agreed, together with a zone-based management of yellowfin catch across the whole stock.

620. The theme convenor noted that a bridging tropical tuna CMM was being drafted and this was an opportunity to raise issues for the Commission.

621. The Philippines reiterated that its domestic catch for 2015 of around 215,000 mt was provisional and undergoing validation. Noting concerns about the increased catches of yellowfin by Philippines and Indonesia, this CCM indicated that this can be attributed to increased data collection over previous years. Philippines noted improvements in data collection: e-reporting and e-monitoring in HSP1, expansion of the national stock assessment program, port sampling activities covering most tuna landing sites, a strengthened observer program, catch documentation and validation, implementation of VMS and other collaborative activities.

622. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on how to further develop catch limit options for yellowfin tuna as specified in paragraphs 28, 29 and 43 of CMM-2015-01. SC12 reiterated its advice from SC11 that yellowfin tuna stock status in the WCPO is relatively insensitive to whether purse seine effort is comprised of mainly associated sets or unassociated sets. SC12 also noted that the latest catch estimates for 2015 suggest that catch of yellowfin in the longline and purse seine fisheries appears relatively stable and as such several CCMs do not consider yellowfin catch limits in the longline and purse seine fisheries to be immediately necessary. Nevertheless, some concern was expressed with the increase in yellowfin catch reported in the "other" fisheries category, particularly in the Indonesian and Philippines handline fisheries, though it was noted that these catches are presently provisional and increases may be attributed to changes in data collection in recent years. SC12 therefore recommended WCPFC13 consider the need for continued improvements for data collection in these fisheries and the need for CCMs to provide information to the Commission on the management tools they have available to them to bring these catches under control.

5.3.2 Other issues related to CMM 2015-01

623. K. Satoh presented SC12-MI-WP-09, examining a management measure of key purse-seine vessels for recovering bigeye tuna stock in the western and central Pacific Ocean. Following CMM 2013-01, a deterministic projection study presented at SC10 was used for yellowfin tuna that calculated relative impact of different effort ratios of purse-seine types (associated or unassociated sets). The study did not assume a stock-recruitment relationship. In order to gain a deeper understanding of yellowfin tuna management, the authors attempted deterministic projection for the yellowfin tuna stock to assume effort reallocation and a spawner recruitment relationship. A future projection result showed that spawning biomass would increase when effort of FAD sets was redistributed to unassociated sets, supporting the effectiveness of the operational shift from associated sets to unassociated sets in the management of yellowfin tuna. SC12 was invited to consider the management options related to purse seine fishery including the key purse seine vessels issue, and to request SPC to conduct related analyses including precise future projections using the vessel-level purse seine data.

624. EU noted the innovative nature of the management measure, and suggested that instead to specific vessels, catch rates are more probably linked to spatial distribution or availability. The catch distribution is often related to bilateral agreements and may change radically according to different situations, according to different time and space distribution, changes which are quite common. It was noted that a similar exercise could be conducted with any fleet.

625. SPC suggested that Japan run a status quo scenario as recent recruitments may lead to stock recovery without management interventions; a comparison between the two scenarios would give a better understanding of the impact of the proposed management intervention. It was noted that due to differences in the formulation of the recent recruitment assumption in TUMAS and those used within approaches based upon stochastic projections such as the tropical tuna CMM evaluations, the results of the two analyses could not be directly compared; this would also affect comparisons of recovery times to a given stock level between the two analyses.

626. PNG could not support piecemeal approaches to amending the CMM and advised that PNA is introducing FAD charging to replace FAD closures. This will have a larger effect on those fishing on bigeye tuna, but was not characterised or included in the stochastic projection.

627. A discussion took place about the first recommendation in the paper but there was not agreement to endorse it, with some CCMs commenting that this kind of projection study should be supported and others noting PNA's management measures, the paper's late posting and comments SPC had made about TUMAS. The theme convenor suggested simply drawing the Commission's attention to it.

628. EU reminded SC of a 2015 SPC examination of purse-seine catches of bigeye (SC11-MI-WP-07) and commented that EU had funded a follow-up, which SPC would complete soon.

629. RMI opined that the lack of agreement to endorse the study brings attention to the need for an SC recommendation about bigeye tuna stocks, for which overfishing is occurring, and recalled FFA had referred to advice from SC to the Commission on a timeframe for recovery.

Exemption from the high seas FAD closure

630. The theme convenor invited SC12 to review proposals from CCMs wishing to claim exemption from the 2017 high seas FAD closure on the basis of footnote 5 of CMM 2015-01 which says: "The high seas FAD closure in paragraph 18 does not apply in 2017 to a CCM that has achieved a verifiable

reduction in bigeye catches by its purse seine vessels to 55% from current levels (2010-2012), to be reviewed on the basis of the advice of the Scientific Committee.”

631. EU commented that, subject to SPC’s confirmation of the numbers, its fleet had significantly reduced bigeye tuna bycatch in 2015 and if this agenda item was the opportunity to apply for an exemption, EU wished to do so. EU was referred to the tables in SC12-MI-IP-06 that illustrate the level of reduction in PS BET catch and indicating that the EU fleet in 2015 had reached and even exceeded the 55% reduction from 2010-2012 levels.

632. PNA Members noted that the CMM 2013-01 High Seas FAD closure exemption was expected to only apply where there has been a sustained drop in bigeye bycatch to the 55% level. A fleet should not continue to be exempted if its bigeye bycatch is not maintained at the 55% level. They proposed that SC advise the Commission that the exemption should apply in 2017 to those purse seine fleets with an average bigeye catch for 2014 and 2015 that is reduced to 55% of their average for 2010 to 2012- data in MI-IP-06 could be used to determine which fleets qualified. Should the high seas FAD closure be extended beyond 2017, exemption should require sustained reduction to the 55% level.

633. The theme convenor noted that the CMM is silent on the time period over which it should be achieved, and there was some uncertainty whether the decrease needed to be sustained. While it was up to the Commission to decide if certain CCMs have achieved that level, SC12 can pass advice from CCMs up to the Commission.

634. Japan commented that SC could point out that there is some uncertainty around this paragraph.

635. EU noted that if the Commission decides these matters and CCMs need to apply during SC meetings, then EU would be applying for this.

Effort creep

636. G. Pilling presented SC12-MI-WP-08: Examining indicators of effort creep in the WCPO purse seine fishery. Graham Pilling (SPC) presented SC12-MI-WP-08, examining indicators of effort creep in the WCPO purse seine fishery. The paper summarised trends in potential effort creep indicators for the tropical purse seine fishery, and their suitability for adjusting WCPO effort limits. The majority of indicators have shown increases over the recent period within the WCPO when examined both within and outside PNA EEZs. The included increases in the number of sets made per day, reflecting an increase in effective effort within fishing day limits. Vessel characteristics, which may better reflect drivers of effort creep, all displayed increasing trends over time. However, identifying a limited suite of vessel characteristics that directly (or indirectly) influence effort creep will be challenging. Catchability estimates from stock assessments should be the ‘best’ indicators of effort creep, but come with practical challenges that include their timeliness. Once an appropriate link between an indicator and effort creep has been established, development of transparent decision rules for desired effort limit adjustment is recommended. These should define the period of data used for the adjustment, the frequency with which adjustment is considered, and potentially a minimum change within an indicator before effort limit adjustments are made. Noting year-on-year fluctuations in indicators, trends between short-term averages should be examined. Ultimately, the approach should be tested for effectiveness within Management Strategy Evaluation.

637. The theme convenor noted effort creep in the purse seine fisheries and new FAD technology.

638. Pilling confirmed this was a key area for further investigation for the FADMgmtOptions-IWG.

639. Japan endorsed the first recommendation, noting that it was also interested in technological improvements on FADs. This CCM noted that SPC provided possible candidates to monitor effort creep, but monitoring or tracking effort creep in real time was not taking place and SC may need to consider other research or find a proxy for the approximate trend. This CCM asked about the general CPUE trend, noting earlier discussions and the CPUE figure in the working paper.

640. Pilling responded that effort was lower in 2015 compared with 2014 which drove the change in overall catch. Regarding a proxy, Pilling noted that using only indicators will not always give an accurate result; the alternative was to find a HCR that is robust to effort creep if it exists.

641. RMI commented that the work in the paper had been requested by PNA to inform consideration of adjusting the VDS TAE for effort creep. It was being presented to the SC to help ensure the effectiveness of the Commission's purse-seine fishery effort limits were not undermined by effort creep, and to begin the work of identifying potential indicators. PNA requested SPC to report annually on trends in effort creep through Table 1 and expressed interested in similar work being undertaken so that any process of adjustment for effort creep would be compatible across the WCPO. RMI noted that the work was also directly relevant to the development of a HCR.

642. The theme convenor noted the comments on effort creep across the WCPO fisheries, including those managed by the PNA VDS, and SC's recommendations would draw the Commission's attention to the work being undertaken and the SC's support for further work.

643. SC12 reviewed a management option to limit bigeye catches on purse seine vessels with higher percentage of bigeye tuna catch to assist the recovery of the bigeye tuna stock in the WCPO (SC12-MI-WP-09) though noted that further work on this option was required to clarify and validate specific outcomes. SC12 was also informed about additional options considered by some CCMs (e.g., the introduction of FAD charges to manage FAD usage in PNA waters) to achieve this same objective. SC12 recommends that WCPFC13 note that there are various options to limit bigeye catches on purse seine vessels when considering additional management measures for rebuilding the bigeye tuna stock within the WCPO.

644. SC12 discussed the request from WCPFC12 to provide comments and/or recommendations to the Commission on proposals from CCMs that wish to claim exemption from the 2017 high seas FAD closure on the basis of footnote 5 of CMM 2015-01. SC12 was informed that the EU would be requesting such an exemption on the basis of the 2015 bigeye catch in the purse-seine fishery according to SC12-MI-IP-06. However SC12 has not been able to review this proposal due to the lack of guidance on how this review should be done. SC12 also noted that the present CMM is unclear as to how this exemption is to be applied as it does not specify a time period over which the drop in bigeye bycatch to no more than the 55% level of 2010-12 average needs to be sustained. SC12 recommends that TCC12 and WCPFC13 clarify how this assessment should be done.

645. SC12 reviewed candidate indicators of effort creep in the WCPO purse seine fishery (SC12-MI-WP-08) noting that SPC had undertaken the work for the PNA to inform consideration of adjusting the Vessel Day Scheme TAE for effort creep. SC12 strongly supported this work, noting that this work was also directly relevant to the development of a harvest control rule for skipjack. SC12 also identified effort creep as an important issue related to all fleets operating in the WCPO and recommends that WCPFC13 note of these comments and prioritise continued research on this important issue.

AGENDA ITEM 6 – ECOSYSTEM AND BYCATCH MITIGATION THEME

6.1 Ecosystem effects of fishing

6.1.1 Review of research and information

6.1.1.1 SEAPODYM

646. P. Lehodey (CLS France), a consultant working with SPC, presented SC12-EB-WP-01, on predicting skipjack tuna dynamics and effects of climate change using SEAPODYM with fishing and tagging data. 2. An updated version of SEAPODYM (version 3.0) was used to revise its application to Pacific skipjack tuna. The major changes implemented in this version are i) revision of the spawning habitat definition, ii) additional parameters for better description of tuna vertical habitat, iii) alternative approach in the likelihood to account for fishing mortality using catch removal, and iv) use of conventional recapture tagging data in the likelihood. The model configuration at a resolution of 2° x month is based on an environmental INTERIM-NEMO-PISCES hindcast (1979-2010). Then the optimal solution achieved is used with three climate projections under the same RCP8.5 IPCC scenario. The new reference solution using tagging data in addition to catch data exhibits more heterogeneous spatial distributions due to higher advection rates and more variable habitats with higher local gradients. As a result the species biomass shows higher concentration in the favourable habitats that match well the main fishing grounds, and much less 'cryptic' biomass elsewhere. At the beginning of 2010, the total biomass is estimated to be 8.1mt Pacific-wide excluding the Philippine-Indonesia region and the fishing impact is about 20% of virgin biomass, reaching 25% for adults. Locally it can be above 40%. The fit to observed catch is good for all equatorial fisheries but deteriorates in regions with complex current systems such as the Kuroshio, not well resolved at this resolution. While the total stock estimates in WCPO are close between SEAPODYM and 2014 MULTIFAN-CL estimate, the results differ between the two models by region, especially in the sub-tropical Region 1, where MFCL predicts much higher and more variable abundance of skipjack. SEAPODYM predicts higher biomass in the two core tropical regions (2 and 3) known to be the main fishing grounds for skipjack. Climate change simulations without fishing show either no long term decline of skipjack biomass or a decrease arriving in the mid-century or later after 2080, due to strong warming of surface waters in the western equatorial region affecting the spawning and larvae development. No species adaptation to warmer spawning temperatures was considered.

647. The theme co-convenor drew SC's attention to SC12-EB-IP-14, a SEAPODYM review with an update about ongoing developments and preliminary results, noting that there were some general conclusions might be relevant to discussions here.

648. Japan asked about the modelling approach and what drove the differences between the MULTIFAN-CL and SEAPODYM models, noting SEAPODYM shows a continual decrease of skipjack tuna but MULTIFAN-CL indicates it goes up and down. Secondly, Japan asked whether there was a plan to evaluate the larvae distribution using field data (other than fishing data).

649. Lehodey noted that they were moving to high resolution and real time forecasting but they had no means to undertake at-sea work. He noted that if there was the possibility to go to sea that would be very useful to have a real time test using model forecast. Regarding historical data, Lehodey noted that broad average larvae distributions derived from Japanese sampling cruises which took place in the 1970s and 80s, were usually compared to model outputs. It was noted that in the comparison between SEAPODYM and MULTIFAN-CL by region, both models showed similar predicted interannual variability of skipjack biomass, while it was not obvious for other areas. Possible reasons to explain these differences include the fundamentally different treatment of recruitment mechanisms in the models, the explicit description of

fish movement in SEAPODYM and the source of errors in the environmental forcing of the model. Lehodey noted that in the main fishing grounds both models converged to the similar level of biomass which was encouraging, adding that it was important to continue to work with the two models, as together they improved the understanding of the behavioural mechanisms. Lehodey acknowledged he could not provide more explanation on why the SEAPODYM and MULTIFAN-CL models predicted different recruitment variability without further investigation.

650. Indonesia expressed interest in the development and improvement of SEAPODYM that is used in the INDESO project for several years. It was mentioned that skipjack tuna distributions predicted by the SEAPODYM operational model for Indonesia had improved since the beginning of the project, based on the known distribution of skipjack in Java Sea and to the east, close to Kalimantan. It was noted that the WPEA project was looking at climate change issues, and guidelines were being developed to deal with future impacts. Indonesia saw the potential for assisting this project using SEAPODYM results.

651. Lehodey emphasised that the operational approach forced rapid improvement of the model, and feedback from CCMs was valuable.

652. J. Hampton made some comments on differences between the models. The MULTIFAN-CL used for the latest stock assessments included changes which might bring it more into alignment with SEAPODYM, noting that while these models showed aligned results they were completely different approaches. SEAPODYM takes into account environmental variability; MULTIFAN-CL has process error which SEAPODYM does not have, particularly with recruitment – it responds to variability and size composition data more than SEAPODYM. SEAPODYM also uses tagging data very differently to MULTIFAN-CL; there will be variability in stock size which is responding in some measure to the tagging data; this is not the case in SEAPODYM. Hampton noted that tagging data in SEAPODYM is used for better characterisation of movement, not abundance as it is the case in MULTIFAN-CL. In MULTIFAN-CL, which has coarse spatial structure, there could be an element of cryptic biomass, whereas in SEAPODYM there are specific estimates of stock size in all spatial cells, even those where fishing does not occur. While MULTIFAN-CL is focusing on stock assessment estimate, SEAPODYM informs on a higher spatial resolution and allows separation of the fishing impact from the environmental effects, including climate change.

653. Lehodey commented that the SEAPODYM model was also strongly dependent on the quality of environmental forcing data it utilises, and advised that using different forcings may bring some differences in the results, even if current ocean physical-biogeochemical models simulate both seasonal and interannual (e.g. ENSO) variability with good skills.

654. FFA members supported further development and application of Projects 62 and 46, including implementation of the 6-point work plan for SEAPODYM considered last year and the outcomes of the review. These CCMs supported work on validating the generality of SEAPODYM results through additional analyses, independent of SEAPODYM, of catch and effort data from ENSO events not included in the optimisation of SEAPODYM. The process of improvement in the application of SEAPODYM to target stocks was useful and FFA looked forward the use of SEAPODYM model results in conjunction with other tools when framing scientific advice to the Commission.

655. Australia was encouraged that the model was continuing to evolve. Its incorporation of explicit movement of fish and environmental forcing means if part of a stock moves to the east, as during El Nino for example, SEAPODYM will take that into account, whereas MULTIFAN-CL might interpret that as high recruitment rather than a movement of fish. Australia agreed that quality of data influences the results and asked what was the main change compared to previous skipjack results with SEAPODYM.

656. Lehodey noted that in the new version there was a lower biomass estimate compared to previous results, due to the use of catch removal and tagging data. It concentrated in the main fishing grounds.

657. Tuvalu supported the continuation of SEAPODYM development and ecosystem modelling, but noted SC does not use the results in framing advice to the Commission. Tuvalu welcomed the outcomes of the review and was pleased to learn that SEAPODYM was now able to be utilised in decision making. The review highlights that SEAPODYM was a useful complement to MULTIFAN-CL for management strategy evaluation work undertaken by WCPFC, which includes spatial management. Tuvalu noted the SEAPODYM focus on spatial distribution, the influence of environmental processes and climate change on tuna population dynamics, which are of significance to PICs and participating territories.

658. The theme co-convenor asked delegations to review SC12-EB-IP-14, a SEAPODYM review, update, preliminary results, and the four recommendations.

659. SC12 recommended that WCPFC13 endorses the results of the review of SEAPODYM (SC12-EB-IP-14) as follows:

SEAPODYM has the potential to be a useful complementary model to MULTIFAN-CL for MSE work that includes spatial management. Similarly, the capacity of SEAPODYM to include alternate oceanographic states (e.g. ENSO phases and climate change projections) would allow climate proofing (reducing risks and capitalizing on opportunities presented by climate change) to be a consideration in the MSE work undertaken by WCPFC.

6.1.1.2 Ecosystem indicators

660. The theme co-convenor noted that SC12 was asked to consider fishery and environmental impacts, based on updated information, if available, including the development of ecosystem indicators.

661. N. Smith (SPC) presented SC12-EB-WP-02, on ecosystem indicators in the WCPFC context, a brief summary of WCPO work in this subject to date, and the outline of a proposed work plan for SC to move forward on the design and testing of ecosystem indicators for the WCPO. Ecosystem indicators recognise that tuna do not live in isolation from the ecosystem which supports them. Even in their simplest implementation ecosystem indicators should enable more precise specification of the range of decisions leading to desired or effective outcomes, and reduce the risk of bad outcomes from those decisions. Especially for the longer lived tunas, ecosystem indicators should increasingly provide early warning of when issues may arise. Such forecasts allow time for better management responses and will be particularly important as we move to making decisions in an MSE framework. Previous work on ecosystem indicators highlights: key challenges, existing data and analyses for the WCPO that could be used for in development, candidate indicators for sharks and monitoring the warm pool pelagic ecosystem, using a range of indicators, and that some can be simple whilst others will need to be more complex. The substantive work is in the design and testing of a range of indicators specific to the WCPFC and its context which will require time and resources. The suite of indicators selected need to be metrics which can be readily used to provide advice, carefully consider the way the WCPFC works, the data available or readily able to be collected, include indicators which characterise the system and its current state, include indicators which provide early signal detection for changes in state, and utilise work done to date and more broadly regionally and globally. Experience in similar work shows that a combination of collaborative detailed technical work, targeted analyses, and broader stakeholder inclusion are critical to development. To progress the design and testing of ecosystem indicators, the work plan starting in 2017 would in year one focus on understanding work to date, and with experts, the SC and our broader stakeholder base, identifying a range of candidate indicators relevant to the WCPO. In year two the work plan would focus on refining design and then testing a suite of ecosystem indicators and reporting to SC.

The programme of work is ambitious but achievable in the timeframes indicated with adequate resourcing.

662. Australia supported developing ecosystem indicators and noted that the question was how to interpret the indicators. This CCM commented that they need to be associated with some kind of appropriate, relevant reference levels.

663. EU noted one initiative funded by the ABNJ Project, trying to promote a global meeting among RFMOs, and commented that ICCAT was looking at identification of indicators.

664. The theme co-convenor advised that the Secretariat was aware of these meetings; the intention was to stay across these discussions and participate where possible.

665. FFA members considered the work on ecosystem indicators to be important and supported reinstating SC11 advice on ecosystem indicators, recognising points raised at WCPFC12 in support of this work. These CCMs supported the priority level of this work as set out in Table 1 of the working paper and suggest it be considered in the SC budget and workplan.

666. USA observed that the review of existing work focuses on tuna RFMOs even though there was a lot of ecosystem modelling happening globally. This CCM asked for further information about what a successful indicator would be in the proposal, what the reference levels were, and whether SC would be predicting and seeing how good those predictions were. USA made the point that stock assessments themselves are ecosystem indicators and advised that prior to expenditure being incurred on this type of effort, these questions would need to be addressed.

667. SPC noted that the point of the first part of the work program would be to look across existing work to ensure SC has the most relevant information available.

668. The theme co-convenor noted that SC12 supported the package of four recommendations in the working paper and, after some comments relating to the needs of the budget ISG, asked SPC to use the Secretariat's template to draw up a TOR, scope and costings for the project so the budget ISG and later the FAC could better evaluate the project for funding. SPC completed a detailed scope for the budget ISG.

6.2 Sharks

6.2.1 Review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks

669. The theme co-convenor noted that the instruction to SC was to review the results of 2016 simulation modelling work conducted under Project 54 (Monte Carlo simulation of mitigation options for longline shark bycatch) and provide comments and/or recommendations on mitigation measures.

670. G. Pilling presented SC12-EB-WP-03, on Monte Carlo simulation modelling of purse seine catches of silky and oceanic white tip sharks. This paper uses Monte Carlo simulation modelling approaches to investigate the impacts of purse seine fisheries on silky and oceanic whitetip sharks under different scenarios of fishing effort on free schools and FAD-associated schools. Two scenarios were explored: the redistribution of effort on FADs to free schools; and, redistribution of free school sets to FAD sets. Probability distributions for school association and species specific shark presence were generated through standardisation of purse seine observer data. It was not possible to fit robust statistical models to non-zero catches. Therefore values were based upon the mean and standard deviation of non-

zero catches identified by observers. Redistribution of effort from FADs to free schools resulted in substantial reductions in estimated catches of silky shark (by 83%) and oceanic whitetip shark (by 57%) compared to the 'status quo'. There was large uncertainty in total catch estimates due to low confidence in assumed estimates of non-zero shark catches.

671. In response to a number of questions from Japan and a comment that the scenarios were extreme case, SPC explained that in the absence of guidance from the Commission it chose those scenarios to illustrate the most extreme cases for FAD/free school set combinations. Related to the question of why covariates such as tuna and oceanographic information were included within the model, SPC explained that an initial statistical model of non-zero shark catches that included these covariates was tested but was found to be inadequate and not used in the final analysis. Estimates were based on stratified shark catches from the observer data. Oceanographic information was included in the model of presence/absence and was significant for silky shark in particular.

672. SPC noted that the analysis assumed a 100% detection rate for sharks. SPC had examined the data comparing reporting of catches and observer measurements of sharks, and found it to be pretty consistent. SPC noted that observers may be doing other jobs onboard and acknowledged that zero catch of sharks is represented as zero sharks caught, but it is actually zero observed.

673. USA commented that the analysis was beneficial for the managers, and sought confirmation about whether that the logit function was used for the environmental variables or did SPC try other distributions that might have been more appropriate.

674. In response SPC noted that a number of distributions were considered for the models and the logit-link model was chosen as it fitted best.

675. In response to a question from PNG about the practicalities of the recommendation that sharks be removed from the net pre-brailing, SPC acknowledged the practicalities and explained that the recommendation was based on records showing that 95% of sharks in the nets were dead; doing something before the sharks came on board was therefore needed.

676. SC12 participants discussed the available data and concluded that catches of silky sharks in the longline fishery are about three times higher than those in the purse seine fishery.

677. ISSF noted published research on post-release survival showing up to 20% of the sharks brought on board would survive if released quickly following good practices (Filmlater et al. 2015). This would apply to both set types: free school and drifting FADs. ISSF was researching ways of getting sharks out of the net before brailing, such as hand lining, which was very promising.

678. EU indicated that its voluntary contribution to the WCPFC for 2016 included support for research on post release mortality of sharks and development of mitigation methods aiming at reducing by catch of these species.

Choice of longline mitigation approaches

679. G. Pilling presented SC12-EB-WP-06, Potential implications of the choice of longline mitigation approach allowed within CMM 2014-05. Using Monte Carlo simulations we compare the outcomes of "status-quo" fishing where use of wire-trace material and shark-lines continues at recently observed levels, with scenarios where each are excluded, either individually or combined, and with scenarios where individual flag-states either choose to exclude the gear they use most frequently, or the gear they use least frequently. The key conclusions of the analyses were that 1) Flag state choice of fishing technique to

exclude (either wire trace or shark-lines) has the potential to greatly reduce the benefits to silky shark and oceanic whitetip shark; and 2) where flag-states choose to exclude the technique least used by their vessels, the median predicted reductions in fishing-related mortality are 6% for silky shark and 10% for oceanic whitetip shark. This compares to reductions of 29% and 40% respectively if choice was removed and both techniques excluded.

680. Japan commented that the CMM allowed the choice of these mitigation methods, so the Commission should have expected the measure to be less effective than if both wire trace and shark lines were prohibited.

681. FFA members noted the simulation work and updates, which highlighted the importance of banning both wire trace and shark lines, rather than the option permitted under the current CMM of banning only one method. This CCM reminded SC that the choice of banning wire trace or shark lines is at the fleet level, not the individual vessel level.

682. FFA members noted that shark lines are set at the depth which is the preferred habitat of oceanic white tips and silky sharks and they will still catch sharks if made from heavy monofilament or some of the new braided lines. While some sharks will bite through the trace material and self-release, some will still be captured. These CCMs stated that consequently both wire trace and shark lines should be banned for the measure to have a significant effect.

683. Japan noted that if both wire trace and shark lines are prohibited, the reduction in mortality is 24% in the case of silky shark, while it would be almost 100% if FAD fishing was prohibited.

684. Fiji made a number of points in relation to the working paper, supporting the collection of data on release method and post-release fate. Noting that silky sharks and oceanic whitetip sharks are the two most frequently encountered sharks in purse-seine sets, these CCMs encouraged industry to undertake research on ways to reduce shark interactions when hauling the net, such as burst panels or larger mesh at the bottom of the net. These CCMs stated that significant reductions in silky and oceanic whitetip sharks could be achieved with greater use of free-school purse-seine sets.

685. USA proposed that this paper and the purse seine Monte Carlo paper (SC12-EB-WP-03) be forwarded to the Commission, noting that the work is to realise the effectiveness of the current CMM.

686. China noted that it had been building capacity for training its fishing industry to work towards the protection of oceanic whitetip shark and silky sharks, including inviting S. Clarke and SPC to conduct a training session last October in China. This CCM stated that it was continuing to improve its capacity in this area, and proposed to undertake similar training sessions this year. China invited SPC and other organisations to help China educate its fishing industry and expression appreciation for technical support from Birdlife International and ACAP for a longline fishery seabird mitigation training session.

687. FFA members urged SC to make a strong recommendation to the Commission to ban wire trace and shark lines across the WCPO as the single most effective method to deal with shark mortality in WCPFC and could be introduced with little expense or significant change to industry fishing practices.

688. Australia noted that the two key conclusions in the executive summary of SC12-EB-WP-06 were pertinent and SC12 should include them in its management advice.

689. EU sought clarification that the study focused on the tropical zone between 20°N and 20°S and asked if this was related to the distribution area of the species concerned. Following the positive answer

received by SPC, this CCM asked what the basis and added value of applying the proposed ban of wire trace and shark lines to the whole WCPFC area.

690. RMI noted the continuing need for increased observer data and submission of data from CCMs. This CCM stated that SC should be making hard recommendations to the Commission on this issue, noting that SPC had concluded that the data for this study were uncertain and asked what the worst case scenario would be if you have full coverage of all fleets. This CCM asked if the data was recent.

691. Pilling noted that one of the issues was the low observer coverage of longline operations in general in the WCPO, commenting that SPC can only use the data that are available. The uncertainty is whether these available data are representative of fleets as a whole; otherwise the numbers in the analysis could be biased and lead to an over- or underestimation of the impact of management measures. Pilling noted that he would have to confirm the period run by the analysis, and reiterated that the bigger issue is the low observer coverage across the fleets.

692. FFA remained of the persistent view that banning wire trace in the WCPO would have a significant impact on reducing shark interactions with longline fishing gear, noting that the Monte Carlo simulation demonstrates this, reducing mortality to 40% for oceanic whitetip sharks and 29% for silky sharks when both wire trace and shark lines are banned.

693. USA understood FFA members' concerns but noted that there are other management options such as large circle hooks which also reduce mortality, and there are several other options. This CCM commented that the role of SC was not to advocate for particular management methods.

694. Fiji noted that under CITES, it was mandatory to release listed shark species whether dead or alive. It was easier, quicker and more cost-effective to not use shark lines or wire traces during fishing operations now, rather than having to cut the lines when a shark is caught or hauling the shark on-board and releasing the shark alive.

695. S. Clarke responded to the recommendation in the paper noting that new observer data minimum data standards and fields now require that hooking location and how the shark is released be recorded by observers. The new observer fields agreed at WCPFC12 now include 'hooked in the mouth', 'hooked deeply in the throat or stomach', and 'hooked externally' as well as 'hook and line removed'. Clarke noted that these fields as well as the fate codes such as 'cut free' or 'discarded' would apply to silky sharks and oceanic whitetip sharks, and should provide the information asked for in the paper. Clarke advised of the July 2016 IATTC changes pertaining to silky sharks. Resolution C-16-06 requires that all purse-seiners adopt a no-retention policy and longliners that are not licensed to target silky sharks must keep their silky shark catch below 20% of the total catch in weight, and those longliners that are licensed to target silky shark are required to observe a 3-month ban on the use of wire leaders.

696. Japan noted that it would work with SPC to revise the Table within the document before TCC, as some of the values for Japan seemed incorrect.

697. EU questioned whether post-release survival rates used within the analysis had been updated since SC11, noting that the uncertainty on the values of these rates was influential on the results of these analysis, and reminded that the EU has proposed to support research into this area.

698. Pilling responded that post-release mortality was still an area in need of more information and the EU proposal would be useful for this purpose.

699. With respect to EU's question on the basis and background for the FFA proposal to ban both wire trace and shark lines, Australia noted that the most recent assessments found that fishing mortality for oceanic whitetip was over six times F_{msy} and for silky shark was over four times F_{msy} . This CCM noted that the information presented in SC12-EB-WP-06 was very clear with respect to how CMM 2014-05 could make an impact on reducing these fishing mortalities, noting that the "least used" scenario is the likely outcome of the present CMM and has very little impact.

700. In response to a question from Indonesia about whether the simulation model differentiated countries that targeted silky shark, Pilling clarified that the model was not looking at targeting specifically, just the gear setup and the patterns of resulting mortality at the fleet level, based upon the available observer data.

701. The theme co-convenor noted that there was no unanimous support for the FFA proposal to ban wire traces and shark lines, but suggested that SC could craft a strong recommendation to the Commission to take note of the results of this work and the reduction and mortality of both oceanic whitetip shark and silky sharks if both methods are not used. SC could also craft a recommendation about improving data collection.

702. Japan gave its support for the general approach but reiterated that mitigation measures for longline and purse-seine should be treated equally.

703. RMI supported improving the observer coverage by flag state so at least the required data can be achieved to enable the information used within the analysis to be updated and called on CCMs to do this, and suggested a recommendation that observer coverage be increased. RMI acknowledged that this was a scientific committee, but SC should not shy away from providing options for managers to enable them to understand the situation.

704. Japan agreed that improved data collection would be beneficial but noted that the table in the paper was not related to observer data but was about gear used.

705. Pilling clarified that the data in the Table was based on information provided by observers in the different fleets and, if greater observer coverage is achieved, more information about the proportions of gear types used by fleet would be available for the table.

706. The theme co-convenor left the agenda item open to receive the report from the small group looking at new guidelines for the survival of sharks other than whale sharks to be released from longline or purse-seine gear, based on any updated information. This group reported back and a number of recommendations were agreed by SC12.

707. The following conclusions of SC12-EB-WP-06 were acknowledged by SC12:

- The possibility offered in CMM 2014-05 to choose which fishing technique is excluded (either wire trace or shark-lines) has the potential to substantially lessen the reductions of fishing mortality to silky shark and oceanic whitetip shark; and
- By choosing to exclude the technique least used by their fishing vessels, the median predicted reductions in fishing-related mortality are 6% for silky shark and 10% for oceanic whitetip shark. This compares to reductions of 24% and 37% respectively if choice was removed and both techniques excluded.

Furthermore:

- Survival rate post release is a crucial factor to evaluate the fishing mortality on shark species.
- CMM 2014-05 entered into force in July 2015 and the fleet gear characteristics data used in this analysis are prior to the adoption of this CMM and covering only a short timeframe.
- Work on the estimation of reliable post release survival rates of sharks and in particular those covered by CMM 2014-05 is prioritised under the SC Work Plan.

708. SC12 also acknowledged the following conclusions of SC12-EB-WP-03:

- Redistribution of effort from FADs to free schools resulted in substantial reductions in estimated catches of silky shark (by 83%) and oceanic whitetip shark (by 57%) compared to the ‘status quo’. There was large uncertainty in total catch estimates due to low confidence in assumed estimates of non-zero shark catches.

6.2.2 Review of conservation and management measures for sharks

a. CMM 2010-07 (CMM for Sharks)

709. The theme co-convenor noted that two information papers had been prepared for these discussions SC12-EB-IP-02, on information available to evaluate the effectiveness of the Commission’s measure on shark finning and SC12-EB-IP-10, an investigation of fin to body weight ratio for blue shark (*Prionace glauca*) caught by Japanese longline fisheries in the North Pacific. The theme co-convenor invited comments or questions on these papers.

710. S. Clarke commented that in SC12-EB-IP-10, Japanese researchers compared weight of blue shark carcasses and dried fins, including severed dried whole caudal fins. This was within the 5% tolerance ratio applied in WCPFC to ensure finning is not taking place. Clarke explained the origin of the ratio comes from a study based on wet fins and wet carcass dressed weight and noted that the fin weight will decrease over time through drying, and SC12-EB-IP-10 reflects that decrease. Clarke commented that this again points out that the 5% ratio is a simplification of a complicated situation.

711. The agenda item was left open in order for interested parties to continue discussions on the fin to carcass ratio in the margins and report back to SC12.

~~712. _____~~

~~713.~~712. _____ Japan noted that its paper was written with the goal of providing information of species specific ratio of fin weight to shark weight, not written with the goal of explaining how Japan implements the ratio and it confirms that there is not enough information to validate the 5% ratio. This CCM noted that its domestic regulation requires fishers to bring back the carcasses and the fins.

~~714.~~713. _____ FFA members supported the definitions of the form of the fins and the form of the carcass being clearly specified but recognised the advice presented at SC11 that shark fin weight data suffered from serious limitations, biases and errors, and an evaluation of the 5% ratio was not possible. FFA members supported amendments allowing compliance officers to match shark fins to carcasses onboard vessels and measures to minimise shark mortality. These CCMs advised that they wished to improve the CMM based on the implementation of technical mitigation measures to reduce shark capture.

~~715.~~714. _____ With regard to CMM 2010-07 (CMM for Sharks), especially related with Paragraphs 4, 8, and 13 with reference to data provision, fin to carcass ratios, and the need for a

revised or new CMM, SC12 recommended that TCC12 and WCPFC13 note that SC12 was able to review the ratio of fin weight to shark carcass weight from one study (SC11-EB-IP-03). This study demonstrated that shark fin weight data have some serious limitations, potential biases and errors. SC12 was unable to confirm the validity of using a 5% fin to carcass ratio in CMM 2010-07 and forwards these concerns to TCC, noting that an evaluation of the 5% ratio is not currently possible due to insufficient information for all but one of the major fleets implementing these ratios. SC12 took note of SC12-EB-IP-02 that confirms that the information which can be used to evaluate the effectiveness of the WCPFC ban on shark finning (CMM 2010-07) is currently very limited.

b. CMM 2011-04 (CMM for oceanic whitetip shark)

~~716~~715. The theme co-convenor referenced information paper SC12-EB-IP-15, evaluating the effectiveness of large-scale marine reserves on wide-ranging sharks. This project involves a sampling program of oceanic whitetips and silky sharks and as there is a potential that sharks may be injured or killed in the process of the tagging program, SC should discuss and endorse any proposal of that nature.

~~717~~716. Australia noted that the proposed project was a James Cook University collaboration with the Cook Islands and sought to investigate the effectiveness of large scale marine reserves. The principal involved in the study sought approval of SC, as sharks will be held for sampling and tag attachment before being released, noting that the requirement of the CMM is that they are released immediately.

~~718~~717. Japan and PNG expressed the view this study was something done independently and, while being advised was welcome, independent research by CCMs did not require endorsement by SC.

~~719~~718. USA noted that the CMM provides for sharks to be immediately released and the reason for an endorsement is to ensure there is no possibility of prosecution of the fishers involved, given the language in the CMM.

c. CMM 2012-04 (CMM for protection of whale sharks from purse seine fishing operations)

~~720~~719. The theme co-convenor noted that according to para. 6 of the CMM, and reviewing reported information in Annual Report Part 1, CCM's and the SC shall continue work on bycatch mitigation measures and live release guidelines to avoid the catch of this species wherever possible, and maximize the number of incidentally caught individuals that can be released alive. The theme co-convenor noted that the ISG would be looking at some of these issues.

d. CMM 2013-08 (CMM for silky sharks)

~~721~~720. There were no comments received from the SC on this agenda item. As with 6.2.2.b, CMM 2011-04 (CMM for oceanic whitetip sharks), SC will continue to work to improve bycatch mitigation measures, and encourage CCMs to collect data on silky shark bycatch and discards. The theme co-convenor noted that guidelines for the live release of sharks were being developed by an ISG during SC12.

e. CMM 2014-05 (CMM for sharks)

~~722~~721. The theme co-convenor noted that para. 2 of this CMM stipulates that CCMs must develop a management plan for longline fisheries targeting sharks, including specific authorizations to fish and a TAC or other measure to limit the catch of shark to acceptable levels. SC12 was asked to review draft guidance for the development and evaluation of management plans for longline fisheries targeting sharks in association with WCPFC fisheries prepared by the Secretariat associated with CMM

2015-04 and elements as stipulated in Attachment J of the WCPFC12 Summary Report, which includes: a range of possible definitions of a longline fishery targeting key shark species; a list of candidate elements to be considered for the development of management plans; and a list of elements to be considered for the evaluation of the management plans.

Shark targeting and management plans

~~723~~722. _____ S. Clarke presented SC12-EB-WP-05, on the elaboration of technical details regarding shark targeting and shark management plans for CMM 2014-05, which was put together through literature review and consultation via Commission Circular. One of the WCPFC's conservation and management measures requires longline fisheries that target sharks to develop a management plan (CMM 2014-05). The measure then tasks the Commission with reviewing the implementation and effectiveness of those management plans. In order to fully operationalize this CMM it is necessary for the Commission to further elaborate some of its technical elements. For this reason, WCPFC12 requested the Secretariat prepare a paper for the consideration of the Scientific Committee and the Technical and Compliance Committee proposing i) a range of possible definitions for longline fisheries targeting sharks, ii) a list of candidate elements to be considered for the development of shark management plans; and iii) a list of elements to be considered for the evaluation of these shark management plans. A working paper (SC12-EB-WP-05) was prepared and presented covering a number of technical and management considerations on these three topics for discussion.

~~724~~723. _____ FFA members commented that two CCMs submitted shark management plans prior to SC in 2015 but no others have been submitted, and noted the suggestion in SC12-EB-WP-05 that all CCMs that catch sharks submit a shark management plan. FFA members reminded SC that the intent of this section of the CMM was that if a CCM or fleet did not want to use mitigation measures a shark management plan was required. For fisheries where both wire trace and shark lines are banned, or where there are non-retention rules or shark sanctuaries in place, there is no requirement under this CMM for a shark management plan. Fleets operating on the high seas that cannot prove that they are not targeting sharks are expected to have a shark management plan containing at least the minimum requirements.

~~725~~724. _____ Japan commented that SC should note that two shark management plans were submitted noting that, as the deadline was last year, other CCMs with substantial shark catch chose not to submit a shark management plan. Japan opined that the Commission had tasked the Secretariat to develop guidelines.

~~726~~725. _____ EU strongly took the view that SC had been asked by the Commission to review the draft guidance document that was circulated and report to the Commission which included a range of possible definitions of a longline fishery targeting key shark species, a list of candidate elements to be considered for the development of management plans and a list of elements to be considered for the evaluation of the management plans. This CCM opined that SC did not have to make any decisions for one definition or another, but it did need to discuss and report on the options. This CCM asked what percentage of total shark catch was covered by the two submitted management plans.

~~727~~726. _____ USA took the view that the CMM's provisions on CCM-specific fishery management plans should not be embraced as a long term solution. Requiring CCMs to develop and implement individual management plans is at odds with the concept of an RFMO establishing obligations that apply collectively to its members. This CCM noted individual CCM FAD management plans had not proven effective. In the short-term the Commission should ensure that CCMs' fishery management plans are reasonably effective and do not involve apparently unsustainable practices, and in the medium and long terms, the Commission should work to develop more universally applied management measures, that are binding and allow CCMs to move forward with Commission-wide agreed upon measures.

~~728~~.~~727~~. _____ China considered that more research was needed.

~~729~~.~~728~~. _____ In response to a proposal from Japan to define shallow set longline as ‘longline fisheries targeting sharks’, Clarke noted that this could be considered under ‘gear’, but there were problems with this approach, related to defining a certain activity as ‘targeting sharks’ just because a vessel is using a certain gear, and the swordfish fishery would fall into this category.

~~730~~.~~729~~. _____ FFA members advised that some CCMs will not have this type of management plan established even for their target tuna fisheries, and considered that a shark management plan could be a significant contribution towards the management of sharks in the WCPFC. FFA members did not want to impose unreasonable burdens on CCMs and delay the development of the plans, and suggested moderation when the shark management plans are assessed against the guidelines.

~~731~~.~~730~~. _____ Australia expressed sympathy for the USA position regarding the current piecemeal approach and how it contributes to the overall strategy for managing sharks in the Convention area.

~~732~~.~~731~~. _____ Korea commented that it had no target shark fishery and did not need to submit a management plan for sharks, and noted that it has implemented the relevant CMMs and a shark National Plan of Action. Korea supported Japan’s comments and asked SC to define what a target fishery was.

~~733~~.~~732~~. _____ Greenpeace commented that while sharks are described as bycatch in longline fisheries, it was clear from common practices that deliberately increase sharks catches (wire traces, shark lines and bait that attracts sharks, and crew payment structures that incentivise shark finning), that most longline fisheries should be described as mixed fisheries targeting tuna, sharks, and billfish. In addition, purse-seine fisheries using FADs catch significant numbers of oceanic whitetip sharks and silky sharks. The fishing mortality on silky sharks from the FAD purse-seine fishery alone was above FMSY. Greenpeace urged SC12 to recommend that the Commission adopt the tiered approach to the development of shark management plans by all CCMs as outlined in SC12-EB-WP-05; they should be kept relatively simple for CCMs in the lowest tier with capacity building support provided. This would represent a significant interim step towards development of shark LRPs and better management and data collection for sharks.

~~734~~.~~733~~. _____ EU recalled that SC had been directed to inform the Commission about specific question, a definition of targeting, and there were options in the paper that could be useful for the Commission to consider.

~~735~~.~~734~~. _____ The theme co-convenor noted the lack of consensus and asked the ISG to meet in the margins and report back to plenary.

~~736~~.~~735~~. _____ S. Clarke, convenor of ISG-11, reported to SC12 on discussions in margins on shark management plans. On 11 August Clarke advised that ISG-11 had met three times during SC12. The Secretariat was tasked by WCPFC12 (WCPFC12 Summary Report, Attachment J) to: Propose a range of possible definitions for "fisheries that target sharks in association with WCPFC fisheries" (with reference to CMM 2014-05, para. 2) Propose a list of candidate elements to be considered for the development of management plans for these fisheries (with reference to CMM 2014-05, para.2), and Provide a list of elements to be considered for the evaluation of these management plans (with reference to CMM 2014-05, para.3).

~~737~~.~~736~~. _____ As required by WCPFC12 (WCPFC12 Summary Report, Attachment J), SC12 reviewed the Secretariat’s recommendations contained in SC12-EB-WP-05.

738:737. SC12 considered that it is problematic to agree and apply a definition of longline fisheries “targeting” sharks, noting that fisheries need not be targeting sharks to be having a significant impact on vulnerable shark stocks. The Commission may wish to refer to the potential definitions in SC12-EB-WP-05 as a starting point for further consideration, if required.

739:738. SC12 recommended that the Commission adopt the contents list at Attachment G for the development of any new shark management plans.

740:739. SC12 recommended that the Commission review newly submitted shark management plans for completeness and quality, with a view toward encouraging continuous improvement and documenting the scientific basis for all national management measures referenced in the shark management plans.

f. Safe release guidelines

741:740. SC12 was asked to refine the ‘Guidelines for the safe release of encircled animals, including whale sharks’ subject to any new information, and continue to develop new guidelines for the survival of sharks (other than whale sharks) to be released from longline or purse-seine gear (Attachment G, SC11 Summary Report), based on any updated information and scientific evidence. ISG-7 was formed to discuss these issues.

742:741. On 8 August H. Kiyofuji, the convenor of ISG-7, noted that there was no updated information provided at SC12. Kiyofuji reported that ISG-7 had met during SC12 and proposed a change in the title of ‘Guidelines for the safe release of encircled animals, including whale sharks’ as the guidelines focus solely on whale sharks. ISG-7 agreed to change the title to ‘Guidelines for the safe release of encircled whale sharks’.

743:742. SC12 agreed to change the title of ‘Guidelines for the safe release of encircled animals, including whale sharks’ to ‘Guidelines for the safe release of encircled whale sharks’.

6.2.3 Shark Research Plan

a. Progress of shark research plan

744:743. M. Hutchinson presented SC12-EB-WP-07, “Assessing shark bycatch condition and the effects of discard practices in the Hawaii-permitted tuna longline fishery”. This project is still in progress. The major objectives of this study are; 1- To quantify post release survival rates of sharks that are captured and subsequently discarded in the Hawaii-permitted deep set longline fishery, 2- Predict survival of shark bycatch species by creating better indices of condition at the vessel and at release and, 3- to identify and recommend best handling practices that will maximize survival potential. There are two components to the project. The first is a shark focus study where comprehensive data codes for observers to better assess and depict the condition of all sharks at capture, the handling methods used to release them and condition at release were developed and tested. The second part is a tagging study where observers are putting survivorship pop-off archival satellite tags (SPATs) on sharks to quantitatively assess post release fate and then identify best handling practices conducted by NMFS Pacific Island Region Observers. Twenty-eight tags have been allocated for each species where 14 are placed on sharks released with the line cut and 14 are placed on sharks where the vessel removes the gear. Four of the WCPFC key shark species are being tagged in this study; blue, bigeye thresher and oceanic whitetip sharks are being tagged in the deep-set (tuna target) sector of the Honolulu based fishery and silky sharks are tagged during tuna trips operating from American Samoa. Preliminary analyses of the shark focus data comparing condition at capture to condition at release were significant ($V = 248049$, $p\text{-value} < 0.001$).

The effects of some handling techniques were also found to drastically reduce release condition. Furthermore, because around 80% of the sharks are released with the line cut and thus with trailing gear we estimate that between 0.3 to 15 meters of trailing gear is left on sharks dispatched in this manner (mean= 7.2 meters). The effects from trailing gear may not be negligible.

745:744. _____ In response to a question from Japan about observer error and subjectivity in judging the condition of the sharks on release, Hutchinson advised that the study included 16 different assessors and it therefore was by nature subjective, but this would hopefully be resolved with the satellite tagging. In response to a question from Indonesia about the ‘line cut’ category and whether this included being cut by a shark or another species, Hutchinson advised that this category is only used when the vessel cuts the line. In response to a question from EU about whether the assessment of the physiological condition of the shark is done with visual observation or other parameters such as blood sampling, are considered. Hutchinson confirmed that physiological indicators are not used, in part because the researchers did not want to expose the animal to more stress. Hutchinson noted that the project was conducted during commercial fishing trips, and it was important to reduce the burden on the fishers.

746:745. _____ S. Clarke noted that WCPFC has some funding to do some work on post-release mortality tagging and asked Hutchinson about the number of species covered and whether the way the animals were handled might make the estimates a ‘best case’ in terms of their post-release condition.

747:746. _____ Hutchinson explained the methodology, whereby observers waited for three sets before beginning to tag animals. At that point the observer instructs the fishers to do exactly what they did normally and had done previously in the three observed sets. Regarding the breadth of species under assessment, Hutchinson explained that the species were chosen on the basis that blue shark was physiologically more robust than others, silky sharks were more delicate, oceanic whitetips were in very low numbers, and, in the case of bigeye threshers, the species was the subject of an upcoming stock assessment.

748:747. _____ J. Larcombe (Australia) convened ISG-6, which met three times during SC12 and was tasked, as outlined in SC12-EB-IP-16, with reviewing, updating and recommending a refined stock assessment schedule under the WCPFC Shark Research Plan and projects for the Commission’s consideration. The ISG-6 report noted ongoing and planned work and included a Table outlining the proposed schedule of analyses and stock assessments.

749:748. _____ **SC12 adopted the review of the Shark Research Plan (Attachment H).**

a. Information on non-key-shark species

750:749. _____ L. Tremblay-Boyer presented SC12-EB-WP-08, a review of available information on non-key shark species, including mobulid species, and fisheries interactions. This analysis reviewed all the observed information for non-key elasmobranch in the WCPO purse-seine and longline fisheries from 1994 to 2015, based on their respective observer programs. It also included an assessment of the available information on *Manta birostris*; *Mobula* spp.; and *Pteroplatytrygon violacea* for consideration of these species for designation as WCPFC key sharks following the criteria outlined in WCPFC Key Document SC-08. Based on longline observations, the fate of fish and condition at capture and release highlighted that sharks tend to be utilized more than rays, which are almost always discarded. Information on the animal’s condition at discard, when available, shows that most individuals are discarded injured or dead across species groups. Observed catch distribution maps and nominal CPUE trends were not presented but are included in Appendix I of this paper, in addition to data summaries performed specifically for *M. birostris*, *Mobula* spp. and *P. violacea*. Based on the assessment of the key shark species designation criteria for *M. birostris*, *Mobula* spp. and *P. violacea*, it was suggested that the management of *M.*

birostris and *P. violacea* would be enhanced if they were designated as key sharks by the WCPFC. In parallel, it was deemed that improving observers' abilities to identify individual *Mobula* spp. to a species level was more likely to lead to improved information in the medium-term, and so it was suggested that the designation would not enhance their management.

~~751:750.~~ China stated that it was difficult for longliners to catch these large fish, and considered that the recommendation was more suitable for the purse-seine fishery.

~~752:751.~~ A number of CCMs supported the designation of manta and mobula species as key shark species.

~~753:752.~~ FFA members supported the designation of Mobulid species as key sharks, particularly as they are proposed for listing on Appendix II of CITES at COP17 this year. These CCMs recommended that TCC consider the operational logistics of including these species in logbooks and the costs involved and that the lead-in time be sufficient for logsheets to be amended and distributed regionally prior to CCMs being assessed under the Compliance Monitoring Scheme. These CCMs noted the lack of fate and condition data from purse-seine vessels and that manta and devil rays released from purse-seine nets have a high post-release mortality rate, which should be further studied. FFA members strongly supported the recommendations in of SC12-EB-WP-04 regarding clarifying the process for SC decision-making on key shark species designation.

~~754:753.~~ However, some CCMs questioned the value of designating manta and mobula species as key shark species, given the number of species already on the list and issues with logbook data.

~~755:754.~~ USA noted that there were now 14 key shark species and recalled that the rationale for designating them as such was to get better data on them, but opined that it was not clear that management was enhanced by listing them as key shark species. USA observed that Category 1 and Category 2 data are not used for stock assessments of these species; observer data are used. This CCM also noted the administrative burden related to revising logsheets each time a new species is added to the list.

~~756:755.~~ Japan noted that these discussions were reminiscent of those that take place in CITES, and observed that listing a species does not necessarily protect a species. This CCM was also cautious about increasing administrative burden.

~~757:756.~~ Australia noted that the accuracy of logbook data for sharks in longline fisheries has historically been quite poor. However, in the case of the Australian longline fishery with the introduction of the e-monitoring system, logbook reporting of sharks had dramatically improved and so adding a new shark species to the logbook would very likely enhance the data available to the Commission. Australia cautioned against a presumption that listing key shark species would not improve data when in some cases it is likely that improvements will occur immediately or in the medium term as approaches to fisheries monitoring develop.

~~758:757.~~ USA noted that only 10-15% of sharks are not represented in the key species list, and typically if a shark is discarded these will be underreported on logsheets. USA noted that there was probably good coherence between the observer records and logsheets for the same longline set; however ~97% of longline sets are unobserved and discards are potentially underreported.

~~759:758.~~ EU made the point that any neglect in Commission attention to this fuels the appetite of CITES to get involved in fisheries management. If the Commission is committed to a science-based approach, it should be wary that these decisions may be taken over by another organisation which may not apply the same scientific approach to decision making.

~~760~~.~~759~~. _____ Chinese Taipei observed that this year ICCAT discussed key shark species, including manta and mobula, but decided not to list them because they cannot do stock assessments on these species.

~~761~~.~~760~~. _____ Sustainable Fisheries Partnership noted that Australia had shown that with the advent of e-monitoring reporting of some bycatch species has improved substantially

~~762~~.~~761~~. _____ An ISG tasked with considering the recommendations in Tremblay-Boyer's paper and reporting back to SC12 was formed, with S. Varsamos (EU) convening the group. On 11 August, Varsamos presented the ISG5 report on the development of key shark species and review available information on mobulid species. The group could not agree to designate the mobulid species. Recommendation 1 in the ISG5 report was supported, but CCMs were not aware of who would determine the designation of shark species. This question was referred to the Secretariat and the Commission legal advisor. It was noted that it would be discussed at TCC12.

~~763~~.~~762~~. _____ Fiji noted that the recommendations were a good way forward, and stated that considering a CMM for mobulid species (mantas and devil rays) was a practical thing to do, as they are highly endangered. This CCM noted that the species are being proposed for CITES Appendix II but this might be upgraded to Appendix I soon.

~~764~~.~~763~~. _____ Varsamos noted that during the ISG-5 discussions, a proposal for a CMM was discussed, but the group could not agree beyond recommending that the Commission note the working paper which had been presented (SC12-EB-WP-08) and SC12-EB-IP-09 (FAO Report of the Fifth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species) and consider adopting a CMM for manta and mobula rays, including operational guidelines for setting and safe release and other relevant management measures.

~~765~~.~~764~~. _____ USA advised that it could lead a group at SC13 to prepare guidelines on the safe release of these species.

~~766~~.~~765~~. _____ Fiji supported USA for mapping the way forward.

~~767~~.~~766~~. _____ EU expressed regret that the ISG could not reach an agreement on the designation of manta and mobula rays as key shark species for assessment, noting that the group had agreed on the ecological concerns faced by these species due to the impact of WCPFC fisheries. This CCM reminded SC that these species are already listed on CMS Appendices I and II, manta rays are listed on CITES Appendix II and mobulas will likely follow in October. EU stated that other international bodies are gradually taking over the conservation and management of sharks and other by-catch species due to the lack of action in RFMOs and believed that SC should send a strong signal to WCPFC13 about the need to address conservation concerns about these species.

~~768~~.~~767~~. _____ ISG 5 assessed the relevance of designating Manta rays, Mobulas rays and pelagic stingrays as WCPFC key shark species for data provision and/or assessment. The assessment was based on the review of SC12-EB-WP-08 "Review of available information on non-key shark species including mobulids and fisheries interactions". It followed the process for the designation of new key shark species developed at SC8. ISG 5 endorsed the conclusions of SC12-EB-WP-08 for the species considered in terms of:

- presence in the WCPF Convention Area
- impact by WCPFC fisheries
- ecological concerns
- data availability

~~769~~768. _____ However, the ISG members were not able to agree on the designation of any of these species as key shark species for data provision and/or assessment. This was mainly due to concerns expressed by some CCMs about the lack of clarity of the current designation process and potential consequences of new designations of key shark species in terms of reporting, logsheet updating and requirements related to CMM 2010-07.

~~770~~769. _____ **SC12 recommended that the process for the designation of key shark species should be clarified by the WCPFC Secretariat and TCC.**

~~771~~770. _____ **SC12 recommended that TCC12 clarifies that the designation of a shark species as WCPFC "key shark species for assessment":**

- 1. is not involving any change in the reporting requirements and logsheets of CCMs;**
- 2. meets the requirements of para 4 of CMM 2010-07;**
- 3. results in its listing under the Sharks Research Plan.**

~~772~~771. _____ **SC12 recommended that purse seine observer training programmes add emphasis to *Mobula* spp. identification as part of their curricula.**

~~773~~772. _____ **SC12 recommends that WCPFC13 takes note of SC12-EB-WP-08 and SC12-EB-IP-09 and considers adopting guidelines for safe release of *Manta* and *Mobula* rays caught incidentally in WCPFC fisheries.**

6.3 Seabirds

~~774~~773. _____ The theme co-convenor noted that SC12's task was to review updated information on seabird interactions with longline fisheries in the Convention Area in relation to the application of CMM 2012-07 (CMM for mitigating impacts of fishing on seabirds) and available research findings, including seabird bycatch rates for longline vessels both smaller and larger than 24 metres and assessment on the utility of electronic monitoring by comparing interaction rates with other options, if available. It was noted that along with working papers, a number of information papers were available for participants.

~~775~~774. _____ K. Knowles (New Zealand) presented SC12-EB-WP-09 on the distribution of highly at-risk New Zealand seabirds in the Western Central Pacific Fisheries Commission area. Tracking data was presented to illustrate the distribution of New Zealand's seabird species at greatest risk from fisheries bycatch – black petrel (*Procellaria parkinsoni*), flesh-footed shearwater (*Puffinus carneipes*), Antipodean albatross (*Diomedea antipodensis antipodensis*) and Campbell's albatross (*Thalassarche impavida*). This data showed that the distribution of all four species of seabird extends north of 30°S, where seabird bycatch mitigation is currently not required by WCPFC under CMM 2012-07 and CMM 2015-03. Band recovery data was also presented for Antipodean and Campbell albatross. This showed that fisheries bycatch was occurring north of 30°S and, in the case of Campbell's albatross, north of 25°S. Based on this information and the information on the distribution of threatened seabirds presented at SC11 (SC11-EB-WP-09), New Zealand is seeking movement of the boundary of the CMM north of 30°S.

~~776~~775. _____ In response to a question from one CCM about whether the distribution of the Campbell albatross was theoretical or actual, Knowles confirmed that it was based on tracking data (Nature Conservancy data and Birdlife International data, which included New Zealand data).

~~777~~776. _____ In response to a question from Japan about the definition of 'high risk' and the IUCN categories for each of the seabirds in the study and New Zealand mitigation practices, Knowles noted that the black petrel is categorised as vulnerable by IUCN and nationally vulnerable by New Zealand; the flesh-footed shearwater is categorised as least concern by IUCN but there was new information

suggesting that this should change, and in New Zealand it is listed as nationally vulnerable. Antipodean albatross is categorised as vulnerable by the IUCN and nationally critical by New Zealand. The Campbell albatross is categorised as vulnerable by IUCN and naturally uncommon by New Zealand. New Zealand conducted a comprehensive risk assessment analysis in 2015. This contains details about the methodology for assessing the birds, as well as the fisheries-related mortality of 70 species and subspecies breeding in New Zealand. It was noted that trawl, bottom and surface longlining, and set-net methods were used in the risk assessment within the New Zealand EEZ. The study included a ratio of annual potential fatalities to the potential biological removal. New Zealand followed ACAP best practice, using tori lines, line weighting and night setting. Seabird mitigation in New Zealand pelagic longline fisheries complies with CMM 2012-07. New Zealand was able to confirm during the meeting that New Zealand requires use of tori lines, and line weighting *or* night setting (not *and* night setting as previously advised). Though this was not provided orally to SC12, it is provided here for completeness.

~~778~~:777. _____ New Caledonia asked about seabird mortality between 25°S and 30°S, noting that their national observers did not see any in this area.

~~779~~:778. _____ SPC noted that this information is available in Table 4 of SC12-EB-WP-12.

~~780~~:779. _____ Knowles acknowledged that paucity of data was a problem in this area related to the level of observer coverage which, for most fisheries, is low. This issue was discussed in SC12-EB-IP-07. Knowles advised that a level of 20% would be required to provide useful information on bycatch numbers and rates. The small size of some of the birds was another part of problem; while large birds like albatross were more noticeable allowing for more band recovery, but smaller birds can be overlooked. In addition, the chance of observing the interaction is extremely low.

~~781~~:780. _____ On the information provided demonstrating the spatial distribution, EU supported the recommendations, noting that if there is evidence that the geographical range of the seabirds is not fully covered by the seabird CMM it makes sense to extend the CMM's coverage to the actual distribution of these species.

~~782~~:781. _____ On considering the wording of the recommendations, Japan noted that not all of the seabirds in the paper are ranked by IUCN as threatened so care should be taken with using that word in the recommendations. Japan observed that seabirds are at risk from fisheries bycatch, but not so much from WCPFC fisheries. Japan also cautioned against the suggested recommendation language of “will enhance” as that could not be said for sure.

~~783~~:782. _____ FFA members noted that NZ breeding seabird species are identified as being at the highest risk from fisheries bycatch and these seabirds are foraging well in into tropical regions north of 30°S of the WCPO. These CCMs also noted that tracking data in the paper clearly shows the spatial use of waters for foraging north of 30°S, and these birds are therefore facing risk of becoming bycatch from longline fishing activity in these waters. FFA members further noted that trials and results show the new hook pod is highly effective at reducing seabird bycatch and does not have a negative impact on target catch rates. These CCMs commented that tracking data in the SC12-EB-WP-09 clearly shows the overall distribution of birds during foraging in areas north of 30°S. FFA Members consider there is sufficient evidence to support shifting the line from 30°S to 25°S, although that excludes EEZs. Chair, FFA members encourage the SC to advice the Commission appropriately in light of this new information.

~~784~~:783. _____ In response to a question from one CCM about whether Campbell albatross are found in the tropical area, ACAP noted that the Campbell albatross can go further north of 10-15°S, and that is not the only albatross species ranging in tropical waters. ACAP observed that other threatened species range

in the area between 25-30S in addition to the species presented by New Zealand, for example the Wandering albatross (Vulnerable) and the Indian yellow-nosed albatross (Endangered).

~~785:784.~~ Chinese Taipei considered that because seabirds are distributed through the whole area, there should be no seabird mitigation exemption.

~~786:785.~~ EU observed that other RFMOs set the boundary at 25°S. As there are other WCPFC CCMs which are members of these RFMOs, they appear to accept there is this threat in these areas.

~~787:786.~~ In response to EU's comment, Japan noted that strengthened seabird bycatch mitigation measures are not applied in the IATTC convention area south of 25°S or 30°S. ~~Japan noted that IATTC does not set the boundary.~~

~~788:787.~~ PNG noted the theme of paucity of data and that the tracking work does not add much to the data. This CCM suggested that if the intention is to forward this issue to TCC, further elaboration of the risk matrix, susceptibility ratios, and the coverage needed for observers to improve the data would be useful.

~~789:788.~~ BirdLife International congratulated New Zealand for providing more information on the risk to vulnerable seabirds between 20°-30°S. It was noted that band recoveries from bycaught birds are especially valuable as banding rates for most species are extremely low so recoveries are also likely to be very low; that any bands are recovered from this region is significant and supports these species' distribution information and their risk from bycatch. BirdLife International noted that lower reported bycatch rates within the 25°-30°S region are not a true indication of risk as observer coverage is very low, and emphasised that the clear evidence of distribution for these vulnerable species extending up to and beyond 25°S, and the relatively high effort in this area, strongly supports the need to move the boundary for mitigation use to 25°S.

~~790:789.~~ The theme co-convenor suggested that the group take the four recommendations in the paper as a basis for further discussion in the margins. This group would be led by Knowles and report back to plenary during the meeting.

~~791:790.~~ **Regarding the results of research on seabird distributions, SC12 recommended that the Commission:**

- 1. Note that the northern limit of the spatial distribution of seabird density data presented extends to areas north of 30°S.**
- 2. Within the southern hemisphere part of the WCPO the main area of distribution for New Zealand's vulnerable seabirds, especially the Antipodean albatross and the black petrel, is south of 25°S.**
- 3. Note that use of effective bycatch mitigation measures across the full range of at-risk seabirds should enhance conservation of those seabirds.**
- 4. Note the above information from SC12 and other relevant information when discussing seabird mitigation measures and request that the TCC consider reviewing the 30°S boundary of the seabird CMM further north.**

Seabird bycatch mitigation measures for small-scale longline vessels

[792:791.](#) K. Oshima (Japan) presented SC12-EB-WP-13, an examination of the effectiveness of seabird bycatch mitigation measures for small-scale longline vessels fishing north of 23°N specified in CMM 2015-03. He presented results from on-board researches conducted in 2015 and 2016 in order to examine effectiveness of tori line for small-scale longline vessels fishing north of 23°N, agreed at WCPFC12. The effectiveness of the tori line of different material was tested using a commercial small-scale longline vessel of < 24 m in total length from February to March in the Western North Pacific off Japan. Experimental fishing operations with the tori line demonstrated substantial reduction of frequency of seabird's attacks on baited hook during line setting and number of seabirds bycaught compared to case of no tori line regardless of the difference. Trial implementation of a light streamer tori line introduced as one of mitigation measures for a large-scale longline caused entanglement with longline gear and tori line without streamer showed better effectiveness on reduction of seabird bycatch. It was concluded that tori line without streamer was the most suitable for seabird bycatch mitigation techniques of Japanese small longline vessels fishing north of 23°N and a light streamer tori line had a potential to cause of operational troubles threatening safety of crews.

[793:792.](#) Australia expressed appreciation that Japan was so active in exploring options for small vessels in the north Pacific. This CCM asked for further information on what distance behind the vessel bird attacks occurred in the study which related to the aerial extent of the tori line. Australia noted that for the three tori line treatments the bird attacks increased at 50 metres behind the vessel, making the tori line somewhat effective at close proximity but less effective further away. Australia asked for clarification that this was because there was no line weighting and the bait was still on the surface and available for the birds further back from the boat.

[794:793.](#) Oshima confirmed that the risk of bycatch is reduced. The height of the tori line was approx. 6 metres and the risk of attack by a seabird was reduced because the aerial extent was guarded from 0-50 metres. Oshima noted that it was difficult to obtain information on bycatch from that far away.

[795:794.](#) In response to a question from EU relating to the number of attacks when streamers were used, Oshima confirmed that, based on their results, the effectiveness of the tori line with the streamer was not much different to that without the streamer as seabirds seemed to avoid approaching the space between tori line and sea surface because it is so close to the rear end of the vessel.

[796:795.](#) Indonesia asked about the method for determining what a 'high density area' was. This CCM also sought information on streaked shearwater abundance, noting that the number of attacks by streaked shearwaters was very high in the research study.

[797:796.](#) Oshima confirmed it was in the view of the fishing master if an area was considered 'high density'. Oshima confirmed that abundance of streaked shearwater was high. Japan confirmed that the population of streaked shearwaters was estimated at over 1 million, so there was little concern about their population.

[798:797.](#) Birdlife International welcomed Japan's continued hard work investigating effective tori line specifications for small vessels. However, this observer considered the results to be inconclusive at this stage due to the high attack rates beyond the extent of the tori lines. Birdlife International also noted the high overall bycatch rates for all treatments, suggesting that additional mitigation methods were required to reduce bycatch on these vessels and looked forward to the results from further testing.

[799:798.](#) FFA members encouraged further study of seabird interactions on small fishing vessels North 23°N on tori line design and comparison across vessel sizes. These CCMs considered it important to investigate the effectiveness and impact of having small longline vessels only subject to one of the mitigation measures in Table 1 of the CMM 2012-07, against the three required for larger vessels. FFA

members were concerned that one method was insufficient to reduce seabird interactions in the North Pacific, taking the view that the most effective measure would be to require all longline fishing vessels in areas north of 23°N to implement the same set of mitigation measures as larger vessels.

~~800.799.~~ Chinese Taipei asked whether any entanglement occurred during the experiment.

~~801.800.~~ Oshima noted that one entanglement occurred across the 35 operations, and this occurred in with a streamer in Segment D (a quarter of the fishing effort in the survey). Oshima acknowledged that the bycatch rate was high in the survey, and noted that information on bycatch rates in ordinary density areas was a next step to investigate.

~~802.801.~~ USA noted the bycatch number per 1000 hooks in Table 1 and commented that part of the experiment design was to go where seabirds are high, so you expect them to be there. This CCM advised Japan that they may want to note in the paper that the study was purposely conducted in areas of high seabird abundance, so the high rates are not necessarily indicative.

~~803.1. Regarding the results of tori line research, SC12 recommends that the Commission:~~

- ~~• Note the tori line options reported here (EB-WP-10 and EB-WP-13), developed especially for small longline vessels, and recognise that some of the options may have the potential to be effective in reducing seabird bycatch. SC12 recommends to continue the experimental trials of tori line designs and procedures adapted to the activities of small-scale longline vessels.~~
- ~~• Consider these tori line designs, together with the information on their effectiveness in reducing seabird bycatch and usability in actual fishing operations, during the review or development of any updated tori line specifications, as will be required for the review of specifications set out in CMM 2015-03.~~

Improving tori line performance in small-vessel longline fisheries

~~804.802.~~ K. Knowles presented SC12-EB-WP-10, on improving tori line performance in small-vessel longline fisheries. The objective of the study presented was to modify existing best practice tori line designs for use on small vessels. Trials were conducted on land and at sea using four commercial vessels. Key findings from this study are that there are numerous designs using streamers that meet best practice guidelines that can be used to achieve 70m or more aerial extent, whilst minimizing the risk of tangling. Key tori line design recommendations are: a backbone made of Dyneema material with 70+m aerial extent; single, long, lightweight streamers; fibretube pole deploying tori line at 6m+; use of weak links; and a monofilament in water section. Future work includes operational trials on New Zealand small vessels.

~~805.803.~~ Chinese Taipei inquired about the gross tonnage of the vessels used in the study, noting that in Asia, small vessels are typically smaller than 100 GRT. Regarding in the paper, Chinese Taipei commented that ‘vessel type’ in the recommendations should consider different vessel types.

~~806.804.~~ As promised during the meeting, New Zealand consulted with capital and confirmed that the vessel sizes were 8, 14, 34 and 165 mt. This information was not provided verbally to SC but is included in this report for completeness.

~~807~~.805. Japan asked whether results were yet available for the fishing operations using tori lines, and, noting that a focus of the study was entanglement, asked whether data on entanglements would be included.

~~808~~.806. Knowles responded that the next phase of the project was to use the lines on commercial vessels, which would happen soon. Regarding tori lines, Knowles noted that in designing the tori lines the objective was to avoid entanglement. Trials focused on getting aerial extent because it is known that the greater the aerial extent, the less likely it is to get entangled.

~~809~~.807. Korea noted in the Japan study the tori lines without streamers brought good results when setting lines, and asked whether there were plans to use tori lines without streamers for the next study.

~~810~~.808. Knowles responded that trials were done on commercial vessels; the plan is to do trials with fully operational vessels. There were some concerns about aerial extent in the Japan study and in New Zealand's view some of the entanglement issues are related to that. Knowles emphasised that New Zealand would work closely with colleagues in Japan, focusing on thoroughly tested international best practice.

809. Regarding the results of tori line research, SC12 recommends that the Commission:

- **Note the tori line options reported here (EB-WP-10 and EB-WP-13), developed especially for small longline vessels, and recognise that some of the options may have the potential to be effective in reducing seabird bycatch. SC12 recommends the Commission to continue the experimental trials of tori line designs and procedures adapted to the activities of small-scale longline vessels.**
- **Consider these tori line designs, together with the information on their effectiveness in reducing seabird bycatch and usability in actual fishing operations, during the review or development of any updated tori line specifications, as will be required for the review of specifications set out in CMM 2015-03.**

Reducing the impact of pelagic longline fishing operations on seabirds

~~811~~.810. Referencing SC12-EB-IP-05, on ACAP advice for reducing the impact of pelagic longline fishing operations on seabirds, on behalf of ACAP, M. Favero expressed appreciation at the number of presentations on seabird mortality mitigation and the work taking place in this area. Favero noted that a couple of major changes had been made to ACAP's best practice advice. Noting that ACAP's best practice advice is more stringent than the WCPFC CMM as well as in conservation measures in other RFMOs, Favero advised that ACAP calls for the simultaneous use of 3 mitigation measures: tori lines, line weighting and night setting. Favero stressed the importance of analysing the effectiveness of tori lines in combination with line weighting, as they work together by defending hooks from seabird attacks, and reducing the area where baited hooks are available to seabirds, respectively. Some of the information presented and questions raised during this session relate to using one or another mitigation method independently of the others. Favero further advised that the revised ACAP best practice advice includes a different line weighting regime, calling for the use of at least 40g within half a metre to the hook, or 60g or more within one m, or 80g or more within 2 metres to the hook. Favero noted that ACAP had also adopted 'hook-shielding' devices as stand-alone mitigation methods. These devices protect the tip and the barb of the hook preventing birds from becoming hooked during the line setting. The adopted hook shielding devices also increase the sink rate because they hold 40g of weight at the hook, so it could be considered a combination of mitigation methods within the same device.

~~812.811.~~ The theme co-convenor noted another two information papers under this agenda item: SC12-EB-IP-06, development and testing of a novel seabird mitigation option, the Hook Pod, in New Zealand pelagic longline fisheries and SC12-EB-IP-07, observer coverage to monitor seabird captures in pelagic longline fisheries.

6.4 Sea turtles

~~813.812.~~ S. Clarke presented SC12-EB-WP-11, results from the first of two joint-analysis workshop on the effectiveness of sea turtle mitigation in longline fisheries, held in Honolulu in February 2016, and ABNJ (Common Oceans) Tuna project sponsored workshop. This workshop characterised current sea turtle interaction and mortality rates under existing fishing operations using observer data representing over 2,300 turtles caught by 31 fleets between 1989 and 2015. Three types of analyses were undertaken for three species of turtles: 1) estimating the effects of various operational variables on interaction rates at the set level; 2) estimating how turtle interaction rates vary by hook position within baskets; and 3) estimating the effects of various operational variables on turtle at-vessel mortality rates. In the first analysis hook category (shape and size), bait species, hooks per basket, and soak time had the largest effect on set level interaction rates, with significant decreases in interaction rates with the use of large circle hooks and/or finfish bait. In the second analysis, interaction rates of sea turtles with deep set longlines were highest for those hooks closest to floats. At-vessel mortality rates were influenced by the turtle species and increased mortality rates with increased fishing depths. It was concluded that mitigation measures based on hook shape and size, bait species, and removal of the hooks nearest each float in deep longline sets should be priorities for further analysis. A preliminary species-specific map of relative abundances was generated and a peer review process is being considered to confirm them. A second workshop (November 2016), will focus on estimating baseline interaction and mortality rates under current fishing operations and testing various mitigation scenarios to determine their effectiveness.

~~814.813.~~ In response to a query from Japan, about an assumption in the long term trend of sea turtles, Clarke clarified that the workshop was not trying to account for time trends but instead specify a relative abundance surface. This is so that if there is fishing effort in a certain area where there is known to be a high turtle abundance, the interaction rate should increase by a factor.

~~815.814.~~ Indonesia asked about the impact on tuna catch of turtle interactions but did not receive information from participants at SC12 and the question was not addressed at the workshop.

~~816.815.~~ USA expressed thanks for the ABNJ project's first sea turtle workshop and looked forward to the second and final workshop.

~~817.816.~~ WWF and Greenpeace urged continued support for this important work. The workshop highlighted the lack of evidence for the current measure (CMM 2008-03), which is intended to reduce tuna fisheries impacts on sea turtles in the region. These observers urged SC12 to recommend: a. an immediate review of the current CMM, which can be more effectively assessed; b. a requirement for the use of circle hooks and fish bait (not squid) for any longline fleets that have not demonstrated effective alternative mitigation measures; c. that observer coverage for longline is increased to a minimum of 20% across gear, fleets and areas to ensure effective monitoring and reporting; d. improvements to monitoring and reporting of bycatch and mitigation measures by CCMS; e. support for the further research proposed at the workshop. These observers stated that improvement in observer coverage throughout the region across all fisheries would have the greatest impact on the management of the region's fisheries.

~~818.817.~~ FFA members asked about the availability of ABNJ project non-public data and asked the Secretariat to explain the conditions and process of participation, sharing data and identify who was responsible for sharing the data.

819-818. Clarke noted that the dataset was only available within the four-day workshop and was only held by the two SPC analysts. None of the workshop participants, or Clarke herself, had access to the workshop data on their own laptops. The WCPFC Secretariat contributed the ROP data, SPC supplied data on behalf of their members, and the US, Japan and Chinese Taipei contributed their data to SPC under confidentiality agreements for use at the workshop.

820-819. China expressed its appreciation to Clarke and the ABNJ programme for supporting capacity building for sea turtle mitigation training and to ISSF for helping to train purse-seine vessel captains in sea turtle mitigation methods.

821-820. FFA members noted the lack of sea turtle research papers presented at SC in past years, despite turtle studies being well advanced in many countries in the region and the significant advances in some longline fisheries to avoid adverse interactions with turtles. These CCMs emphasised the importance of continued collection and provision of sea turtle data including interaction rates in tuna fisheries.

822-821. The theme co-convenor suggested that SC12 would note the results of the first workshop and recommendations for future work in the paper, and that SC looked forward to the results.

823-822. SC12 recommends that the Commission notes:

The results from the first workshop on Joint Analysis of Sea Turtle Mitigation Effectiveness in Longline Fisheries. The workshop considered data from 31 fleets and factors associated with 2,300 observed sea turtle interactions. The results indicated that interactions rates are lower when large circle hooks are used, higher at the two hooks closest to the floats and higher when squid baits are used.

The recommendations for future work are noted and look forward to receiving the results from the second workshop to be held in November 2016.

6.5 Bycatch mitigation for other species

824-823. No papers were submitted and there was no discussion under this agenda item.

6.6 Data exchange

825-824. SC12 reviewed a process to populate the Bycatch Data Exchange Protocol (BDEP) template, and review the first BDEP template for 2013-2015.

826-825. P. Williams and N. Smith presented SC12-EB-WP-12, on the trial use of the Bycatch Data Exchange Protocol (BDEP). SPC prepared and formatted the ROP bycatch data it holds into the BDEP for the years 2013-2015. Only ROP data were included in the analysis, a subset of the total observer data held by SPC. In doing the work several issues were identified including the need to: link purse seine effort data and observer reporting of species of special interest, include a table of observer effort by 5x5 degree to aid data interpretation, obtain distinct vessel identifiers to avoid filtering all data from those fleets without such identifiers according to the WCPFC data rules, update length-length and length-weight relationships for BDEP for species of special interest so that more accurate estimates of catch in both number and weight can be determined, update the BDEP protocol to report seabirds to the species level, and expand the BDEP protocol to marine mammals at the species level. The paper proposed that the BDEP tables be published as public domain information on the WCPFC web site (at <http://www.wcpfc.int/tuna-fishery-data>) and any developments with the BDEP tables be addressed within

the annual generic paper on data gaps and related issues. It further proposed that subject to resourcing, it would now be possible to undertake a trial regional BDEP compilation for purse seine at the scale of the Pacific Ocean in co-operation with the IATTC and CCSBT Secretariats.

| [827-826.](#) During discussions, some CCMs asked about the ‘exchange’ aspect of the BDEP. It was noted that originally the template was intended to facilitate exchange of data between data holders either within or between RFMOs, however the current BDEP is currently primarily about compilation and making WCPFC information available in a way that is useful for our own purposes.

| [828-827.](#) S. Clarke (Secretariat) clarified that the BDEP template was discussed with other RFMOs to determine if they would like to undertake a trial; some have agreed to do so, such as IOTC which will discuss their template in September at their Working Party on Ecosystem and Bycatch. Clarke noted that the current goal was to get each RFMO to compile and review their bycatch data and each RFMO will likely want to modify the template in some way. Exchange between RFMOs is not currently planned.

| [829-828.](#) USA welcomed the BDEP trial and continuation of the work. This CCM noted that USA submits ROP data to the Commission but also supplies in-zone data, and asked whether both datasets were used.

| [830-829.](#) SPC clarified that the coverage tables identify the entire SPC data holdings (Table 2), but that the in-zone data had not been included in the detailed tables as they are not ROP data.

| [831-830.](#) USA provided permission to use the in-zone data for BDEP for the next 3 years, subject to the usual confidentiality regime with SPC.

| [832-831.](#) Japan queried whether SPC communicates with other RFMOs about the specifications of the data for exchange.

| [833-832.](#) Smith noted that there was communication with RFMOs on this matter prior to SC11, but based on feedback at SC11 this communication was paused until SC recommends that it continue.

| [834-833.](#) Korea asked for clarification about why BDEP was 5x5 degrees, noting that CCMs are required to submit purse-seine at 1x1 degree resolution.

| [835-834.](#) SPC clarified that BDEP is 5x5 degrees for dissemination, but noted that the observer data are submitted at the operational level.

| [836-835.](#) WWF, Sustainable Fisheries Partnership, Birdlife International, and Greenpeace stated that the BDEP will provide a basis for significant improvement of data on key bycatch species such as sharks and seabirds, play an essential role in ensuring transparency about the ecosystem effects of fisheries and provide clarity on bycatch data. This will assist CCMs in developing sustainable management plans, complement existing management regimes for targeted species, and assist CCMs in meeting obligations under CITES. Should it be allowed to develop, it will provide a practical template that will become increasingly populated as more data come into the public domain. The pilot project was showing progress within WCPFC and IOTC. These observers urged SC to support the extension of the BDEP and recommend an allocation of sufficient resources to the Secretariat to ensure the BDEP’s continuation and improvement.

| [837-836.](#) Having reviewed the trial population of the template, FFA members preferred a three-year trial for the protocol. These CCMs suggested that sharing aggregated information through a global clearing house or a centralised data repository may be a more appropriate model. These CCMs could not

support sharing Commission aggregated data and other information with third parties until further trials and reviews of the protocol template are undertaken and once it was ascertained that other t-RFMOs were willing to share their templates.

| ~~838:837.~~ _____ Japan noted that FFA members had suggested a trial stage. Japan's preference regarding the conclusions in the report was to support Option A (see paragraph 841 below).

| ~~839:838.~~ _____ The following recommendations were made in SC12-EB-WP-12:

1. The BDEP trial should continue
2. Publish BDEP as public domain information on the WCPFC web site
3. Resolve issues for estimating mortality rates for purse seine
4. Provide a table of observer effort by 5°x5°
5. Request vessel identities in observer data where missing (seek advice from the respective CCMs)
6. Report seabirds to the species level, where possible
7. Expand the BDEP protocol to marine mammals to the species level, where possible
8. Review and update length-length and length-weight relationships for BDEP for SSIs
9. Undertake a trial regional BDEP compilation for purse seine at the scale of the Pacific Ocean, in co-operation with the IATTC and CCSBT Secretariats (subject to resourcing).

| ~~840:839.~~ _____ SC12 noted that the [Bycatch Data Exchange Protocol \(BDEP\)](#) is currently designed for the purpose of dissemination of bycatch data.

| ~~841:840.~~ _____ SC12 considered the following three options for future work:

- A. Basic, no-cost (reprioritise other data management tasks). Continue trial in 2017-18 (1), publish on web (2), with any issues addressed in the generic data gaps paper.
- B. Enhance, low cost. As for A., plus, resolve purse seine form links (3), provide table of observer effort (4), resolve vessel identifiers (5), report seabirds to the species level (6), include marine mammals (7).
- C. Focus, moderate cost. As for B., plus, review and update L:L and L:W relationships for SSIs (Species of Special Interest) (8), and undertake regional trial (9).

| ~~842:841.~~ _____ SC12 recommended that the Commission notes that SC12 recommends the choice of Option A (Basic, no cost).

AGENDA ITEM 7 – OTHER RESEARCH PROJECTS

7.1 West Pacific East Asia Project

| ~~843:842.~~ _____ SC12 was briefed on the progress of the WPEA project, a GEF-funded 3-year project working together with Indonesia, Philippines and Vietnam and managed by the Secretariat. The WCPFC Science Manager noted the key activities common to all three countries: a. data collection from port sampling, landed catch, logbook, VMS, and the observer programme, and submission of annual tuna catch estimates through data review and a catch estimates workshop; b. capacity building in science, compliance and management; and c. development of specific guidelines on adaptive management and monitoring of highly migratory fish stocks against the impact of climate change; d. market-based sustainability through tuna supply chain analysis and eco-labelling and/or certification; e. issues related to reference points, HCRs and sub-regional stock assessments; and f. the ecosystem approach to fisheries management guiding sustainable harvest of the oceanic tuna stock and reducing by-catch of sea turtles,

sharks and seabirds. It was noted that each country has activities as needed: in Indonesia a logbook awareness workshop in tuna landing ports with vessel captains to improve the accuracy and return rate; and development of a harvest strategy framework for the archipelagic tuna fisheries; b. in Philippines, publication of the Operational Guide for Filipino Fishermen, and a review of national fisheries laws and regulations in compliance with WCPFC requirements; and c. in Vietnam, reconstruction of catch histories prior to 2000; and translation of the WCPFC 2015 CMMs into Vietnamese. Activities will be held this year and the WPEA Project Board meeting (formerly Steering Committee) will be held in October. A mid-term project evaluation is anticipated in mid-2017.

| [844.843.](#) Indonesia, Philippines and Vietnam thanked the Commission for its support under this program, and SPC and the WCPFC Science Manager for their generous support and hard work.

| [845.844.](#) Indonesia acknowledged the WPEA activities since 2010. Under the program Indonesia was able to provide annual catch estimates by specific gear size, which assisted other activities including the development of the national tuna management plan and harvest strategies within Indonesian archipelagic waters, which was making good progress. Indonesia started developing a national observer program, authorised on 16 May 2016, which Indonesia hoped to develop to fulfil the requirement to provide operational data to the Commission. Indonesia also planned to develop mitigation and adaptation relating to climate change. Traceability and supply chain activities were also underway. Noting that the WPEA provided good outputs for Indonesia, this CCM hoped the efforts for this project would continue.

| [846.845.](#) Philippines noted that this capacity building project greatly helped it to participate in the work of the Commission. Through the WPEA project Philippines had participated in the three-country stock assessment workshop, and had assisted the Philippines to improve their data collection activities. This CCM hoped that the Commission would continue to support the project.

| [847.846.](#) Vietnam noted that SPC had convened a sub-regional workshop in Vietnam to discuss the possibility of a forum for tuna fishery management. It was noted that Vietnam's tuna fishery was quite different from other members' – it was a very small-scale fishery, which needed to be considered.

| [848.847.](#) FFA members noted improvements in data collection and reporting during in the last couple of years, especially from the Philippines, as outlined in SC12-ST-WP-01 but observed that Indonesia and Vietnam have yet to provide aggregated or operational level data to the Commission. These CCMs requested that the provision of this data be addressed as a matter of priority.

7.2 Pacific Tuna Tagging Project

| [849.848.](#) J. Hampton presented the report of the 9th Steering Committee meeting Pacific Tuna Tagging Project. The Steering Committee noted the work undertaken in 2015-2016, which included a tagging cruise in the central Pacific, an exploratory cruise in PNG, ongoing tag recovery work and data analysis and modelling. It was noted that the work plan for the coming year included a bigeye-targeted tagging cruise in the western Pacific, and continued tag recovery and analytical work. The PTTP Steering Committee made the following recommendations to SC12:

- a) that the tagging programme be normalised as part of the ongoing work of SC, ideally with cruises every year alternating between skipjack-targeted via pole and line fishing in one year and bigeye-targeted via handline and dangler fishing in the next and starting with skipjack in 2017 (yellowfin would also be covered by these surveys); and

- b) that SC supports efforts to identify sustainable financing of the tagging programme, through a combination of WCPFC budget support and voluntary contributions from WCPFC members or other stakeholders.

~~850~~849. _____ FFA members recognised that ongoing tagging activities were a critical support to stock assessments, understanding stock movements and enabling reliable measures of absolute abundance for stocks. These CCMs noted with concern SPC advice that the Japanese pole and line fisheries upon which the indices of abundance in the skipjack assessment relied, were declining and the ability to track the abundance of skipjack was at risk as this fishery now only represented 10% of skipjack catch; a reliable abundance index was needed for the assessment. It was noted (SC12-RP-PTTP-02) that a dedicated skipjack tagging programme should occur every second year from 2017, and a bigeye/yellowfin tagging programme should occur every second year starting 2018. This programme would provide valuable data for assessments. These CCMs noted the considerable cost of the programme and urged an investigation into whether there are other viable and cost effective options. FFA members supported the proposed tagging program in 2017 for skipjack and 2018 for bigeye and yellowfin tuna, supported SPC's proposal to include the tagging programme in the WCPFC science programme with surveys repeated every two years for tropical tuna species if tagging is considered the most cost effective approach to meet assessment needs for tropical tuna species and maintain a reliable index of abundance for skipjack and recommended that SC commission an independent study to review the costs and benefits of alternative indices of abundance for skipjack tuna.

~~851~~850. _____ **SC12 endorsed the two recommendations of the PTTP Steering Committee above.**

7.3 ABNJ (Common Oceans) Tuna Project-Shark and Bycatch Components

~~852~~851. _____ S. Clarke presented a brief overview of the ABNJ (Common Oceans) Tuna Project activities being led by the WCPFC Secretariat and SPC, comprised of shark data improvement and harmonization, shark stock status assessment, and bycatch management and information. Over the past year the project has contributed to the adoption of new ROP minimum standard data fields for bycatch, whale shark safe release guidelines, the first WCPFC bycatch data summary template (BDEP), and a global browser tool for t-RFMO shark data; the project would continue to engage with other t-RFMOs on the latter two initiatives. Two of four Pacific-wide stock status assessments were underway in the form of a southern hemisphere porbeagle shark assessment and a bigeye thresher shark assessment. On the topic of bycatch mitigation, SPC continued re-developing the BMIS, and the first joint analysis workshop on sea turtle mitigation effectiveness was held in Honolulu in February 2016. The second workshop to complete the analysis will take place in Honolulu in November 2016. An expert workshop to develop an experimental design for a WCPO shark post-release mortality tagging programme was contemplated for January 2017. Clarke invited feedback from stakeholders on current and proposed activities, and noted that opportunities for synergistic collaborations were continually being sought by the project.

~~853~~852. _____ Noting that information about a Hawaii and American Samoa tagging project had been presented earlier in the meeting, USA noted its willingness to collaborate in post-release mortality tagging projects in the Pacific, urging consistency in project design.

~~854~~853. _____ Clarke noted that the work being undertaken by M. Hutchinson (USA) was exactly the kind of study the ABNJ project wanted to undertake, and hoped Hutchinson and other experts would be participating in the workshop in January. The project focused on oceanic whitetip shark and silky sharks right now, and was open to suggestions. Clarke noted the EU offer to provide 400,000 euro to the Commission to undertake this kind of work and perhaps pool those resources to have the best possible approach to this work.

7.4 WCPFC Tissue Bank (Project 35b)

~~855~~854. J. Hampton (SPC) provided a report on the work of Project 35, which consists of research on the age and growth and reproductive biology of bigeye tuna and the operation of the WCPFC Tissue Bank. It was noted that bigeye biological research is now entering the analytical phase, after several years of sample collection. 1,100 otoliths and 200 gonads are currently being processed with the work to be completed by the end of 2016; this information will be incorporated into the 2017 bigeye tuna stock assessment. It was noted that the Tissue Bank is fully operational and several requests for access to samples were actioned during the year. A request for a \$15,000 increase in the annual budget for the project (to \$95,000) had been made during SC to allow the services provided by CSIRO (sample receipt and customs clearance, storage, documentation and curation) to be secured on a sustainable basis.

~~856~~855. In response to questions from Japan about the revised tissue bank procedure and the WCPFC research sub-committee, the WCPFC Assistant Science Manager, Tony Beeching, explained that nominated researchers who have identified a need to access the WCPFC tissue bank to undertake research do not have to follow the selection and approval process (set out in Paragraph 10 of the protocol) but all the other access protocols will apply. Regarding the research sub-committee, it was noted that this body already exists and is engaged when the Commission requests tenders for a research project. It typically includes the SC theme convenors, the SC Chair and a representative from SPC.

~~857~~856. **SC12 adopted the revised WCPFC Tissue Bank Project protocols (Attachment I).**

AGENDA ITEM 8 – COOPERATION WITH OTHER ORGANISATIONS

~~858~~857. SC12 reviewed the status of cooperation with other organizations.

~~859~~858. The WCPFC Science Manager noted in SC12-GN-IP-01 that Article 22 of the Convention requires the Commission to collaborate with other intergovernmental organizations which may contribute to the attainment of the objective of the Convention, to promote cooperation and collaboration in areas of mutual interest. The Commission had ten existing arrangements and no additional agreements had been signed since SC11. SC12 was advised that close cooperation between WCPFC and IATTC had continued throughout the year, including on a pan-Pacific bigeye stock assessment, cross-accreditation of observers and developing harmonized measures. A Joint Meeting of t-RFMOs on Ecosystem-based Fisheries Management Implementation is scheduled to be held in October 2016 and a t-RFMO Management Strategy Evaluation Meeting is scheduled to be held in December 2016.

AGENDA ITEM 9 – SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

~~860~~859. SC12 discussed intersessional activities related to science capacity building, including for developing States and participating territories supported by the Commission's Special Requirements Fund and the Japan Trust Fund (JTF).

~~861~~860. WCPFC Assistant Science Manager, Tony Beeching, noted that 2016 was the fifth and final year of the second phase of the JTF. WCPFC received just over USD\$140,000 in support of the JTF

fund this year and funding for projects in Fiji, Niue, SPC, and Tonga had been provided. Compliance and data collection were particular foci of the funding. A JTF steering committee meeting was in the margins of SC12, which discussed the status of each project and any challenges. Fiji had noted difficulties in meeting their targets due to the cyclone this year; Japan will follow up in a bid to extend the timeframes of the project. The recipients expressed their strong appreciation for the fund. SC12 was advised that Japan had agreed to extend the JTF program for one more year and to prepare proposals early. It was noted that there was a possibility of a third phase of the JTF.

| ~~862~~.~~861~~. _____ FSM and Nauru noted that they were recipients of JTF funding and thanked Japan for this support. Nauru noted that it had received an extension and had not yet spent the funding but would soon.

| ~~863~~.~~862~~. _____ FFA members noted the funding in support of the regional observer coordinators workshop and stock assessment workshops this year, which built capacity and helped progress work directly relevant to WCPO-specific scientific analyses and stock assessments. These CCMs commented that the special requirements of SIDS did not necessarily require financial support, but a recognition that SIDS should not bear a disproportionate burden of action for conservation and management of tuna stocks fished largely by other flags in the PIC EEZs. These CCMs commented that institutional capacity should be taken into account regarding the monitoring, data-processing and inspection requirements of major market states.

| ~~864~~.~~863~~. _____ The SC Chair thanked Japan for the extension of the JTF.

AGENDA ITEM 10 – FUTURE WORK PROGRAM AND BUDGET

10.1 Review of the Scientific Committee Work Programme

| ~~865~~.~~864~~. _____ SC12 was briefed on the status of the SC11 work programme. In addition to the ongoing data management and other advisory services provided by SPC, the Assistant Science Manager highlighted as specific outputs the skipjack tuna and south Pacific blue shark stock assessments and the annual south Pacific albacore trends paper and an MSE Expert workshop held by SPC. SPC authored or co-authored 46 papers submitted to SC12 (23 of which were working papers). This work was completed under three main funding routes: the core Service Agreement with SPC, individual project contracts, and the use of the unobligated budget for 2014. It was noted that an unobligated budget was not provided for 2015. Science projects supported by EU supplementary funding were detailed, and a brief mention was made of two upcoming grants under development by NZ.

10.2 Development of the 2017 Work Programme and budget, and projection of 2018-2019 provisional Work Programme and indicative budget

| ~~866~~.~~865~~. _____ SC12 developed the 2017 SC work programme and budget and provisional work programme and indicative budget for 2018-2019 for the Commission's endorsement at WCPFC13.

| ~~867~~.~~866~~. _____ R. Campbell (Australia) presented the report of ISG-1, which had considered scientific projects proposed in the context of the indicative budget, and developed the SC budget for 2017 – 2019.

| ~~868~~.~~867~~. _____ **The SC 2017 Work Programme and budget and provisional work programme and indicative budget for 2018-2019 were adopted (Attachment J).**

AGENDA ITEM 11 – ADMINISTRATIVE MATTERS

11.1 Process for the independent review of stock assessments

~~869~~.868. _____ SC12 reviewed a proposal to establish a formal process for the independent review of stock assessments and cost implications which had been developed through the meeting by ISG-3, which had been convened by K. Bigelow (USA). Bigelow made some brief remarks before SC adopted the report, noting that ISC assessments were included in the peer review process but noted that SC was not sure how it would be done given that ISC undertakes assessments by committee. Two candidates from each CCM would conduct the peer review. Three candidates from a shortlist of eight would be chosen to undertake the work. Bigelow noted that an informal discussion with SPC about a possible start time for the review process. Because SPC was undertaking the MSE work as well as three stock assessments in 2017, 2018 was a more appropriate year to start the peer review process. It was noted that the document produced by ISG-3 and endorsed by SC would go to the Commission for a decision on the process and schedule, and SC13 would agree on a budget for a peer review to occur in 2018.

~~870~~.869. _____ SC12 endorsed a process for the independent review of stock assessments (Attachment K).

11.2 Future operation of the Scientific Committee

~~871~~.870. _____ FFA members requested that the number of ISGs be rationalised and that for SC13 they should commence their work as soon as SC13 opens after decision in HOD to reduce inefficiencies and delays in progressing the Committee's work. FFA members considered that it was time to review the structure and operational processes for SC meetings, noting the large number of papers submitted and presented to the committee. It was further noted that about 40% of the meeting papers were submitted after the deadline, and digesting them was an unreasonable expectation of delegates. These CCMs considered that the Secretariat, the Chair and convenors take on a greater role in screening and determining what is accepted and presented, under rules which were originally put in place – i.e. information papers should not be presented, and late-submitted papers should not be accepted (with occasional special considerations). In addition, these CCMs suggested that the agenda is refined to ensure that only items with working papers or substantive issues are considered by the Committee.

~~872~~.871. _____ Australia supported FFA's comments, noting that the Stock Assessment theme convenor had presented work for 17 species but there was no new information for a number of them. This CCM suggested identifying which species the Committee should deal with each year, and prioritise items for which there was new information, and the same could be done for the Ecosystems and Bycatch theme.

~~873~~.872. _____ China suggested that theme recommendation text should be provided one or two days in advance to give CCMs enough time to consider them adequately.

~~874~~.873. _____ EU broadly supported FFA's suggestions, but further added that CCMs should have the opportunity to see the draft agenda as early as possible so they can plan to provide additional information under various agenda items.

~~875~~.874. _____ The Secretariat noted that a provisional annotated agenda should be prepared 90 days prior to the SC meeting. Convenors can modify agenda items if no working papers are available. These were reflected in SC12 agenda in track changes and posted on the website.

| ~~876.875.~~ As Management Issues theme convenor, R. Campbell (Australia) requested that authors contact convenors as soon as possible after the SC meeting notice goes out in late May each year if they have a paper to present, and that this request be added to the meeting notice.

| ~~877.876.~~ As Ecosystem and Bycatch theme convenor, J. Annala (New Zealand) noted that it was difficult to plan a theme session from paper titles and brief abstracts only. In addition, it was noted that a number of the theme working papers were not submitted until the weekend before the meeting started, which made it hard to allocate them to the correct agenda item. Timely submission was important and the Committee needed to be ruthless about rejecting papers not submitted by the due date.

| ~~878.877.~~ The Secretariat noted that it would prepare guidelines reflecting these comments into the meeting notice. Australia undertook to update the guidelines for convenors for review at SC13.

| ~~879.878.~~ WWF expressed support for NZ's comments and pointed out that WCPFC11-2014-OP02 provided a number of mechanisms that could be employed to improve the efficiency of the SC.

11.3 Election of Officers of the Scientific Committee

| ~~880.879.~~ SC12 considered nominations for SC Chair, SC Vice-Chair and theme convenors.

| ~~881.880.~~ Indonesia thanked outgoing SC Chair, L. Kumoru for his leadership and support of the SC previously.

| ~~882.881.~~ The SC Chair B. Muller was approved as SC Chair for the next 2 years.

| ~~883.882.~~ The SC Vice-Chair, A. Batibasaga, reconfirmed his availability to complete his two year term.

| ~~884.883.~~ The theme convenors and co-convenors reconfirmed their availability for SC13, but it was noted that a co-convenor was needed for the Data and Statistics theme as B. Muller was confirmed as SC Chair. This post would be filled intersessionally.

11.4 Next meeting

| ~~885.884.~~ SC12 confirmed that SC13 in 2017 would be held in the Cook Islands and proposed that SC14 in 2018 be held in Korea.

AGENDA ITEM 12 – OTHER MATTERS

| ~~886.885.~~ Indonesia made a statement urging SC to develop tools to estimate the catch from IUU fishing and related activities, and conduct analysis to deliver appropriate advice on IUU fishing to managers. This statement is at **Attachment L**.

AGENDA ITEM 13 – ADOPTION OF THE SUMMARY REPORT OF THE TWELFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

| ~~887.886.~~ SC12 adopted the recommendations of the Twelfth Regular Session of the Scientific Committee, noting that they had been worked on extensively during the theme sessions. According

to the Rule 33 of the Commission’s Rules of Procedure, the following procedure for the development of SC12 Summary Report was agreed on by the SC12 plenary.

Due by	Activity
11 August	Close of SC12
18 August	Theme convenors receive SC12 draft summary report for review from the Secretariat
23 August	The Secretariat receives theme convenors’ comments
23 August	The Secretariat posts the provisional Executive Summary on the SC12 website
26 August	The Secretariat distributes the draft summary report to all CCMs and Observers by email
30 September	The Secretariat receives comments from CCMs and Observers

~~888.887.~~ On behalf of his fellow convenors, R. Campbell (Australia) passed on their appreciation to Jane Broweleit, the rapporteur.

AGENDA ITEM 14 – CLOSE OF MEETING

~~889.888.~~ The SC Chair noted that this was her first experience as Chair, and expressed her appreciation to SC for the opportunity to learn the process. SC12 had experienced some challenging moments but the committee had navigated them. The SC Chair noted the opening remarks of the Commission Chair which had outlined three priorities of establishing harvest strategies, agreeing a bridging CMM on tropical tuna, and improved shark management, and noted that there were valuable discussions during the meeting on these issues. The SC Chair asked the meeting participants to pass on the committee’s appreciation to the co-authors of papers and fellow researchers for the quality of scientific papers presented to SC12. The SC Chair thanked those who had served the committee including convenors who shaped the meeting, those who managed the flow of information and papers, and those who served as note takers and rapporteurs, noting that a good quality report would be sent to the Commission to assist deliberations in December. The SC Chair thanked SPC-OFP for its valuable scientific work and participation, the WCPFC Secretariat and the government of Indonesia for their hospitality and the generous meeting arrangements. The SC Chair paid tribute to a dearly departed friend of the Commission, Nanette Malsol.

~~890.889.~~ The Executive Director congratulated SC on behalf of the Secretariat and the Commission Chair for what had been achieved at SC12, observing the formidable agenda set for SC12 and the large amount of material participants had worked through over nine days. The Executive Director thanked participants for their contribution and perseverance including presenters, the scientific services provider team and the theme convenors whose work laid the foundation for Commission decisions, noting that the Commission is required to base its decisions on the best available scientific advice. It was noted that TCC would continue the work on issues deliberated on at SC, and noted the series of upcoming meetings – the CDS-IWG 2016 (16-17 September 2016), the FADMgmtOptions-IWG (28-30 September 2016) and a workshop dedicated to developing a new strategic planning framework. The Executive Director noted the large number of ISGs during SC12, which had been tasked to review a number of technical issues, and would take on the views expressed under Agenda item 11.2 to improve the efficiency and effectiveness of the SC. The Executive Director noted that in constructing the agenda, the Secretariat uses the record of the Commission meeting, reflecting the tasks the Commission has given it as well as ongoing work of SC itself. The Executive Director reassured CCMs of the transparency of the committee, and noted that each CCM has the opportunity to input into the finalisation of the agenda which is provisional until adopted at the beginning of each SC meeting. The Commission observers were

thanked for their contributions to the meeting and other Commission activities. The Executive Director acknowledged his staff at the Secretariat for delivering quality support for the proceedings, and Dr Jane Broweleit for documenting the discussions for the summary report which would be used to plan activities for TCC and the Commission meeting in December.

| ~~891.890.~~ _____ On behalf of the Ministry of Marine Affairs and Fisheries, Indonesia expressed thanks to SC and noted the hard work of ensuring sustainable tuna fisheries. Indonesia thanked the Secretariat for administering the meeting over almost two weeks in Bali. It was hoped that SC participants would be back in Indonesia someday soon and would take home good memories of Indonesia.

| ~~892.891.~~ _____ On behalf of SC12, Fiji thanked Indonesia and the Ministry of Marine Affairs and Fisheries, the great hosts of the meeting, the Honourable Minister Susi Pudjiastuti and the staff who had helped with the logistics. It would be difficult to reproduce the hospitality and kindness participants had experienced through the nine days of the meeting.

| ~~893.892.~~ _____ The meeting closed at 3:20pm on Thursday 11 August 2016.

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

**Scientific Committee
Twelfth Regular Session**

Bali, Indonesia
3-11 August 2016

List of participants

CHAIR

Berry Muller

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

**Scientific Committee
Twelfth Regular Session**

Bali, Indonesia
3-11 August 2016

**Welcome speech by the WCPFC Executive Director
Feleti P. Teo**

Madam Chair; Ms Berry Muller

Our gracious host; Mr Muhammad Zulficar Mochtar; Chairman of the Agency of Marine and Fisheries Research and Development

Distinguished delegates

Colleagues

Ladies and gentlemen.

We gather here again in Bali, Indonesia after only 8 months since the Commission met in this very room for its 12th annual session in December, 2016. It is in this very room that the Commission decided and tasked the Scientific Committee to undertake specific tasks. Those tasks are now embedded in the agenda for the Scientific Committee for deliberations over the course of this week and next.

2. But before I turn to the details of some of those tasks, let me acknowledge with sincere gratitude our host, the Government of Indonesia for its generosity in offering Bali and these magnificent facilities as venue for the meeting of the Scientific Committee this year.

3. For those of us that were here in December last year, we would recall fondly the warmth and generosity of Indonesian Balinese hospitality. The same hospitality also awaited and greeted us on this occasion of the Scientific Committee meeting. So on behalf of all of us gathered here, delegates and observers and members of the Secretariat staff I voice our collective appreciation and commendation to you Chairman Mochtar, on behalf of the Government of Indonesia, for the excellent meeting arrangements and for the sincerity and largess of your hospitality.

4. Since the last meeting of this committee, the Committee Chair Mr Ludwig Kumoru of PNG gave notice of his inability to continue as chair. For those of you that may not know, Mr Kumoru was appointed as the new CEO of the Office of the PNA and he assumed office on Monday this week. So I wish to take this occasion to publicly congratulate Ludwig for his new appointment and to thank him for the services he rendered the Commission as the Chair of this Committee for the last three years.

5. As a consequence of Ludwig's departure, a replacement was needed. As you know these appointments are matters for the Commission. So an out of session decision of the Commission was sought and as you all know by now, Ms Berry Muller of the Marshall Islands was duly appointed. So our congratulations and commendation to you madam Chair for taking on the role of the Chair of this Committee and you can count on the full support of the Secretariat.

Madam Chair and distinguished delegates.

6. As you know we have a very lean science team at the Secretariat but the Commission has a huge science workload as reflected by your extensive meeting agenda. Fortunately for us at the Secretariat, we do have a formidable support team that carries the bulk of the science work for the Commission. And I wish to publicly acknowledge their contribution and commend them for their sterling efforts.

7. I do acknowledge our science services provider OFP of SPC led by Dr John Hampton and his very capable team. Thank you John for the continued support and the high quality services rendered by you and your team.

8. In support of the SC Chair in transacting the business of the Committee, are the theme conveners who I also acknowledge and thank them for their enormous contribution. I wish to personally acknowledge Robert Campbell of Australia; Jon Brodziak of the USA; John Annala of NZ; Hiroshi Nishida of Japan; and Aisake Batibasaga of Fiji and to thank them for their contribution.

9. Traditionally, this committee normally sanctions the convening of several informal small groups to consider specific issues. The HOD meeting yesterday, in keeping with tradition sanctioned the convening of 11 small working groups with designated facilitators. And I will like also to acknowledge these groups and their facilitators and thank them in advance for their work and contribution.

10. Now turning to the work ahead for this session of the Committee, like in the past the Committee's business will be transacted through the 4 key thematic areas of data and statistics; stock assessment; management issues; and ecosystem and bycatch mitigation.

11. In terms of the data issues, though we still have data gaps there have been significant improvements, especially in relation with data collection from the East Asian Seas through WPEA Project and the submission of operational catch and effort data from distant water fishing nations. There is also interesting work done to date on electronic reporting and electronic monitoring and the Committee will get an opportunity to consider the outcomes of the ERandEM working group that met immediately prior to this meeting.

12. The Committee will review four stock assessments; that of skipjack tuna and South Pacific blue shark conducted by SPC; and the Pacific bluefin tuna and Pacific blue marlin by the International Scientific Committee (ISC). I acknowledge with appreciation, on behalf of the Commission, the services provided by ISC.

13. Those of you that were at the Commission meeting here last year, would recall that the Commission directed this Committee to include harvest strategy related issues under the Management Issues theme, so that the earlier conversation on harvest strategies held through the management option workshops continues. In support of this body of work, SPC hosted a Management Strategy Evaluation Expert Workshop late in June and this Committee will have the opportunity to discuss the outcomes of that workshop.

14. In the context of the work plan on harvest strategy adopted by the Commission in this very room 8 months ago, I draw the attention of delegates to the circular issued by the Commission Chair on 15th July, 2016. The said circular circulated a list of draft management objectives for the 4 tuna species, proposed for recording by the Commission at its meeting at the end of the year as required by the work plan on harvest strategy.

15. The Committee will consider issues relating to sharks, seabirds, and sea turtles under the Ecosystem and Bycatch Mitigation theme. Though much more needed to be done, it is worth highlighting the good progress achieved by the Commission on the five-year Shark Research Plan and related research and monitoring and management of shark.

16. Madam Chair that is a quick snapshot of the work that lies ahead for the Committee for this week and next. As the agenda and the meeting documentation attest, it is a formidable body of work we have to get through. I am, however, confident that there is more than sufficient capacity and resources with this room for us collectively to navigate successfully through that body of work.

17. Madam Chair, before I conclude my remarks I wish to draw the Committee and its members to two important developments.

18. The first is to inform members of the Committee that the Commission Chair in the same circular of 15th July, I mentioned earlier, has circulated a Chair's Consultative Draft of a Bridging Tropical Tuna CMM. The draft CMM is intended to succeed the current Tropical Tuna CMM which is due to lapse at the end of 2017. The objective of having the draft CMM out this early is to allow maximum time to initiate extensive and the broadest consultations on the draft CMM well in advance of the Commission meeting in December, 2017 when the Commission is expected to adopt a successor CMM for the current Tropical Tuna CMM.

18. The other development is to update members and observers of the Committee on the progress on the work to develop new strategic and corporate plans for the Commission as sanctioned by the Commission in its last meeting. A USA based consulting firm called Consensus Building Institute has been contracted to facilitate the process to develop those plans. The first phase of the process has commenced which entails the widest consultation through interviews and surveys with members and stakeholders. The Secretariat will be assisting the facilitator in organizing those interviews and the distribution of questionnaires. An online survey will also be arranged, so keep an eye out on the Commission website for that online survey so you can provide input into the development of ~~these~~ [this](#) strategic planning document for the Commission.

19. Madam Chair, I don't want to take up much more of the Committee time, as we do have a substantial agenda to get through. But let me assure you Madam Chair that my staff that are here in Bali stand ready and available to support you and the Committee in its deliberations over the next 8 days.

20. I wish you Madam Chair and the Committee well in your deliberations.

Thank You.

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

**Scientific Committee
Twelfth Regular Session**

Bali, Indonesia
3-11 August 2016

**Welcome Remarks by the Chairman of Agency for Marine and Fisheries Research and
Development, Ministry of Marine Affairs and Fisheries, Indonesia
Muhammad Zulficar Mochtar**

Ladies and Gentlemen,

Assalamu'alaikum Wr. Wb.

Good morning,

It is with great pleasure that I take part in the opening of this very important event to welcome all delegates from member countries and participants to the 12th Regular Session of the Scientific Committee of the WCPFC. I would also like to express my appreciation particularly to the Executive Director Mr. Feleti P. Teo, the Science manager Dr. Sung Kwon Soh, the chair of scientific committee Ms Berry Muller and the Scientific Committee of the WCPFC to give us an honor to host this meeting.

Indonesia with the second longest coastline in the world, lies between Pacific and Indian Oceans and has large archipelagic waters, highest biodiversities and multi-gear fisheries with the significant size of population for around 250 millions people and 20 millions of fishers making fisheries management in this area much more challenge. This Area with large number of fishers no less than 20 million fishers contributes for around 18 % of the total catch of tuna form WCPFC convention area for Skipjack, yellowfin and bigeye only.

As a participation in Regional scale, Indonesia has been a member of 3 Regional Fisheries Management Organizations (RFMOs), i.e. WCPFC, IOTC and CCSBT, and a cooperating member of the Inter-American Tropical Tuna Commission (IATTC). Along with the effort of those RFMOS to manage tuna sustainably, Indonesia has developed The National Tuna Management Plan (NTMP) which more focused on managing tuna in our archipelagic waters including its harvest strategy and this has been formalized by the issuance of ~~Ministrial~~[Ministerial](#) Decree No. 127/2015 on [the](#) National Tuna Management Plan.

IUU fishing and overexploitation today are major concern for the future of Indonesia's fisheries. A slow process in providing scientific advice for appropriate management will make a potential delay having a proper management and A negelecting of IUU in scientific asdvice will potentially add uncertainties and lead to fisheries management failure theatening not only the fish reources but also the livelihoods of million peoples who rely on fishing. Thus this scientific group has very important role to not only give appropriate advice to the managers in the right time but also advice which possible to enforce and also help to eliminate the IUU.

In some cases scientific advices were required a complete data and take a long process yet to be found complicated and expensive, A strong management reforms which inline with scientific advice should be able to demonstrate improvement on global small scale fishers welfare, not only focusing on sectoral and fragmented profit.

In this case not only stock status but also other issues that affect adversely to the stock such as IUU fishing should be addressed, In addition, Indonesia has put a lot of effort to tackle IUU fishing, fish laundry and fish mafia. Indonesia has a very strong regulation on fisheries from 2009 which enforce tough punishment for any IUU activities. For the last two years Under Minister Susi's direction Indonesia's IUU policy proved able to reduced significantly foreign and national IUU fishing. This due to our integrity with a strong implementation and enforcement, more than 200 vessels were arrested and most of them were destroyed. we all agree that IUU fishing is not only Indonesia problem, it is also our neighbour country problem, China, Thailand, the Philipine, Vietnam, Malaysia, PNG and also Australia we all agree that IUU fishing is an Organized Crime, that IUU fishing in no manners should allowed to operate in our water

Our ministry policy, in other hand the investmen in a small-scale fleet for small scale fishers were encourage and this demonstrates to reduces fishing effort and capacity by a net 35 % and will lead to along term increase in catch as long as domestic fishing effort is well-managed. This is taken based on understanding that all resource is for the sake for the prosperous of all people with fairness principles. Which today mostly small scale fishers that involving more people are at risk on poverty with low salary, human slavery, mal nutrition and bad health insurance up to date remain in our big home work

In relation with that, there are other areas that will give benefit to share and discuss either in this scientific commitee or in the Compliance and commission meeting. Those issues, in this opportunity such as additional issues on safety at sea, slavery, smuggling, environment polution and trade fairness might be worth and important to include in the discussion on those meeting.

Nationally, some endeavours have been taken to address those issues to reduced fishing presure and to practice the sustainable and environmentally friendly fisheries, Indonesia has started to implement catch certification, banning on the operation of trawl and trawllike gears, moratorium on vessell built outside and importantly the issuance of the ministerial regulation no. 57/2014 on the banning of transshipment which has been implemented since 2015.

Global issues related climate change, blue carbon and its mitigation are also Indonesia's national concerns. As a real action, Indonesia has reinforced the emission reduction commitment by issuing the Presidential Regulation No. 61 in 2011 approving the National Action Plan for Greenhouse Gas Emissions Reduction (RAN-GRK) also known as the National Mitigation Action Plan.

Indonesia strongly attempts to conduct management for its tuna fishery by implementing the principles of conservation, management and development of the fishery under the Code of Conduct for Responsible Fisheries (CCRF) and comply with management measures of the RFMOs by incorporating the measures within Indonesian fisheries Act and regulations, and its national plan of action. In the meantime, Indonesia has been trying to improve its compliance to the WCPFC management measures and the other two RFMOs, VMS and logbook implementation, and it is an on-going process.

In the last three years, there is an rapidly improvement and increse in participation and attention from the fisheries industries and NGOs in ensuring the sustainable fisheries by applying the precautionary approaches through reporting their catch to the Indonesia Government. Hence the data will be utilized in development of aechipelagic fishery management.

It is our hope that we maintain and improve our collaborations. I would express our thank to all organizations and international community to assist us to improve the fisheries management in Indonesia, ~~S~~specifically, to the WCPFC for its long collaboration and assistance to Indonesia. I also would like to thank the organizers of this meeting for the excellent work they have done.

I hope this workshop will meet its objectives and that to achieve those we should work hard, steadfastly and persistently working together.

I wish us all very successful endeavours and cooperation in the spirit of mutual partnership and beneficial during our deliberations.

Thank you.

Wassalamu'alaikum Wr. Wb.

Chairman of AMFRD
Ministry of Marine Affairs and Fisheries
Muhammad Zulficar Mochtar, S.T, M.Sc

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

**Scientific Committee
Twelfth Regular Session**

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Agenda

AGENDA ITEM 1 OPENING OF THE MEETING

- 1.1 Welcome address**
- 1.2 Meeting arrangements**
- 1.3 Issues arising from the Commission**
- 1.4 Adoption of agenda**
- 1.5 Reporting arrangements**
- 1.6 Intersessional activities of the Scientific Committee**

AGENDA ITEM 2 REVIEW OF FISHERIES

- 2.1 Overview of Western and Central Pacific Ocean (WCPO) fisheries**
- 2.2 Overview of Eastern Pacific Ocean (EPO) fisheries**
- 2.3 Annual Report – Part 1 from Members, Cooperating Non-Members, and Participating Territories**
- 2.4 Reports from regional fisheries bodies and other organizations**

AGENDA ITEM 3 DATA AND STATISTICS THEME

- 3.1 Data gaps**
 - 3.1.1 Data gaps of the Commission
 - 3.1.2 Species composition of purse-seine catches
 - a. Review of Project 60 outputs
 - b. Implementation of observer spill sampling
 - 3.1.3 Potential Use of Cannery Receipt Data for the Work of the WCPFC
- 3.2 Regional Observer Programme**
 - 3.2.1 ROP longline coverage
- 3.3 Electronic monitoring and electronic reporting**
- 3.4 WCPFC-funded Port Coordinators**
- 3.5 Review of *Scientific Data to be provided to the Commission***
- 3.6 FAD Management Options Intersessional Working Group**
 - 3.6.1 FAD research plan
 - 3.6.2 Update on consultancy on FAD marking and identification of FADs
 - 3.6.3 FAD data to be provided by vessel operators
- 3.7 Economic data**

AGENDA ITEM 4 STOCK ASSESSMENT THEME

4.1 WCPO tunas

4.1.1 WCPO bigeye tuna (*Thunnus obesus*)

4.1.1.1 Review of research and information

- a. Research on population structure of tropical tunas
- b. Improvement of MULTIFAN-CL software for stock assessments
- c. Update of WCPO bigeye stock assessment information

4.1.1.2 Provision of scientific information

- a. Stock status and trends
- b. Management advice and implications

4.1.2 WCPO yellowfin tuna (*Thunnus albacares*)

4.1.2.1 Review of research and information

- a. Update of WCPO yellowfin stock assessment

4.1.2.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.1.3 WCPO skipjack tuna (*Katsuwonus pelamis*)

4.1.3.1 Review of research and information

- a. Review of 2016 skipjack tuna stock assessment

4.1.3.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.1.4 South Pacific albacore tuna (*Thunnus alalunga*)

4.1.4.1 Review of research and information

4.1.4.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.2 Northern stocks

4.2.1 North Pacific albacore (*Thunnus alalunga*)

4.2.1.1 Review of research and information

4.2.1.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.2.2 Pacific bluefin tuna (*Thunnus orientalis*)

4.2.2.1 Review of research and information

4.2.2.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.2.3 North Pacific swordfish (*Xiphias gladius*)

4.2.3.1 Review of research and information

4.2.3.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.3 WCPO sharks

4.3.0 Stock status indicators for key shark species

4.3.1 Oceanic whitetip shark (*Carcharhinus longimanus*)

4.3.1.1 Review of research and information

4.3.1.2 Provision of scientific information

- a. Status and trends
- b. Management advice and implications

4.3.2 Silky shark (*Carcharhinus falciformis*)

4.3.2.1 Review of research and information

4.3.2.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.3.3 South Pacific blue shark (*Prionace glauca*)

4.3.3.1 Review of research and information

4.3.3.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.3.4 North Pacific blue shark (*Prionace glauca*)

4.3.4.1 Review of research and information

a. Evaluation of North Pacific blue shark as a northern stock

4.3.4.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.3.5 North Pacific shortfin mako (*Isurus oxyrinchus*)

4.3.5.1 Review of research and information

4.3.6 Pacific bigeye thresher shark (*Alopias superciliosus*)

4.3.6.1 Review of research and information

4.4 WCPO billfishes

4.4.1 South Pacific swordfish (*Xiphias gladius*)

4.4.1.1 Review of research and information

a. Research on South Pacific swordfish biology – aging, growth and maturity (Project 71)

4.4.1.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.4.2 Southwest Pacific striped marlin (*Kajikia audax*)

4.4.2.1 Review of research and information

4.4.2.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.4.3 North Pacific striped marlin (*Kajikia audax*)

4.4.3.1 Review of research and information

4.4.3.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

4.4.4 Pacific blue marlin (*Makaira nigricans*)

4.4.4.1 Review of research and information

4.4.4.2 Provision of scientific information

a. Status and trends

b. Management advice and implications

AGENDA ITEM 5 MANAGEMENT ISSUES THEME

5.1 Development of harvest strategy framework

5.1.1 Management objectives

5.1.2 Reference points

a. South Pacific albacore

b. Bigeye tuna

- 5.1.3 Implications of alternative levels of acceptable risk
- 5.1.4 Performance indicators
- 5.1.5 Monitoring strategy
- 5.1.6 Harvest control rules and management strategy evaluation
- 5.1.7 Harvest control rules and management strategy evaluation for northern stocks
- 5.2 Limit reference points for WCPFC sharks**
- 5.1.1 Identifying appropriate limit reference points for elasmobranchs for the WCPFC
- 5.3 Implementation of CMM 2015-01**
- 5.3.1 Yellowfin tuna catch limit
- 5.3.2 Other issues related to CMM 2015-01

AGENDA ITEM 6 ECOSYSTEM AND BYCATCH MITIGATION THEME

6.1 Ecosystem effects of fishing

- 6.1.1 Review of research and information
 - 6.1.1.1 SEAPODYM
 - 6.1.1.2 Ecosystem indicators

6.2 Sharks

- 6.2.1 Review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks
- 6.2.2 Review of conservation and management measures for sharks
 - a. CMM 2010-07 (CMM for Sharks)
 - b. CMM 2011-04 (CMM for oceanic whitetip shark)
 - c. CMM 2012-04 (CMM for protection of whale sharks from purse seine fishing operations)
 - d. CMM 2013-08 (CMM for silky sharks)
 - e. CMM 2014-05 (CMM for sharks)
 - f. Safe release guidelines
- 6.2.3 Shark Research Plan
 - a. Progress of shark research plan
 - b. Information on non-key-shark species

6.3 Seabirds

6.4 Sea turtles

6.5 Bycatch mitigation for other species

6.6 Data exchange

AGENDA ITEM 7 OTHER RESEARCH PROJECTS

- 7.1 West Pacific East Asia Project**
- 7.2 Pacific Tuna Tagging Project**
- 7.3 ABNJ (Common Oceans) Tuna Project-Shark and Bycatch Components**
- 7.4 WCPFC Tissue Bank (Project 35b)**

AGENDA ITEM 8 COOPERATION WITH OTHER ORGANISATIONS

AGENDA ITEM 9 SPECIAL REQUIREMENTS OF DEVELOPING STATES AND PARTICIPATING TERRITORIES

AGENDA ITEM 10 FUTURE WORK PROGRAM AND BUDGET

10.1 Review of the Scientific Committee Work Programme

10.2 Development of the 2017 Work Programme and budget, and projection of 2018-2019 provisional Work Programme and indicative budget

AGENDA ITEM 11 ADMINISTRATIVE MATTERS

11.1 Process for the independent review of stock assessment

11.2 Future operation of the Scientific Committee

11.3 Election of Officers of the Scientific Committee

11.4 Next meeting

AGENDA ITEM 12 OTHER MATTERS

AGENDA ITEM 13 ADOPTION OF THE SUMMARY REPORT OF THE TWELFTH REGULAR SESSION OF THE SCIENTIFIC COMMITTEE

AGENDA ITEM 14 CLOSE OF MEETING

**The Commission for the Conservation and Management of
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**Scientific Committee
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Bali, Indonesia
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**Research recommendations prepared by the SPC South Pacific stock assessment team on the
South Pacific blue shark**
(collated from SA12-SA-WP-08 and SC12-SA-WP-09)

Recommendations pertaining to the collection and analysis of observer data:

- Given its importance (in particular length data) in these assessments, efforts to expand observer coverage for longline fleets operating in the WCPO is strongly recommended;
- pending availability of resources, analysis of the statistical power of WCPO observer coverage configurations to detect changes in spatio- temporal abundance of bycatch species is recommended;
- it is recommended that SC develop a strategy to ensure that observer deployments are spatially and temporally representative of fishing effort, and to inform this strategy, spatial and temporal observer coverage for each fleet be reported and evaluated in an SC observer data gaps review paper;
- Emphasis on improving the consistent collection of accurate observer effort during the set is needed, as this variable is essential to the estimation of accurate by-catch rates;
- Given larger individuals may not always be brought on-board, we recommend an investigation into whether there is a size bias in recording length;
- To support future sex-specific modelling in blue shark, we recommend that observers report sex of sharks for all fish handled;
- We recommend provision of expanded metadata to facilitate merging variables from different programs into a single harmonized database. This could be assisted by an active collaboration of member countries with SPC during the initial merging operation.

Recommendations pertaining to the collection and analysis of logsheet data:

- We recommend that, pending availability of resources, SPC undertake a systematic, fleet-specific evaluation of the nature and extent of data quality issues as a specific project and report the findings to SC13;
- It is recommended that the use of Electronic Monitoring approaches be pursued to supplement observer coverage;
- It is recommended that approaches to ensure full enumeration of key shark catches in logsheets (both retained and discarded) are pursued;
- Provision by all fleets of operational covariates like hooks-between-floats and set time to interpret CPUE trends is encouraged.

Recommendations for future catch reconstructions:

- It is recommended that an investigation into blue shark catch, effort and length data prior to 1994 be undertaken, particularly for the South Pacific high seas driftnet fishery;
- It is recommended that future catch reconstructions utilise data sources additional to observer data, such as trade data;
- Noting the increase prevalence of regulations aimed at managing WCPO shark mortality, future catch reconstruction should prioritize the inclusion of discard mortality scenarios;
- We recommend active collaboration between interested CCMs for any South Pacific blue shark assessment occur, e.g., through expert workshops.

Recommendations for biological studies

- Noting the paucity of biological data for this assessment, we recommend further work focused on growth, mortality, reproduction and movement for South Pacific blue shark;
- Geographical expansion of currently localized tagging activities would assist future assessments. Improvement of the utility of tagging information from recreational fisheries is recommended, which is currently limited by uncertainty in the length at capture information;
- We recommend that further work on stock structure be undertaken for blue shark in the southern WCPO to confirm the assumption of a single stock;
- Gaining information on key mating, parturition and nursery grounds for the South Pacific is recommended to support the development of targeted data collection programmes, for data analyses and potential management interventions;
- It is recommended that an investigation of the potential for modern genetic techniques, such as gene tagging and close-kin genetic analysis, to provide fishery independent indicators of population size be undertaken.

Recommendations for future assessments

- It is recommended that the project “Develop proposed target and limit reference points for elasmobranchs” continues to be prioritized so that planned stock assessments for sharks in the WCPO be effectively translated into management advice;
- The availability and quality of additional sources of data existing east of the WCPFC-CA should be carefully considered before future stock assessments for South Pacific blue shark occur;
- Noting the significant catch of blue sharks and other species of interest associated with the Southern bluefin tuna fishery within the WCPFC-CA, increased collaboration with the concerned parties for the purpose of assessing WCPO stocks should be pursued.

Model oriented recommendations

- Alternative formulations of the stock recruitment function within Multifan-CL could be considered for future assessments, including the potential to incorporate shark specific information of reproductive biology (e.g. litter size);
- We recommend that the potential to place a prior on the unexploited stock size be examined.

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Scope of work to progress development of limit reference points for sharks

SC12 adopted the following scope for Project 57:

Project 57: Identifying appropriate Limit Reference Points (LRPs) for elasmobranchs within the WCPFC

Background:

The Commission endorsed SC11's request of USD 25,000 for the continued development of limit reference points for elasmobranchs. The Commission tasked SC12 to develop a scope of work to progress this work within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). SC12-ISG-2 also supported the project collaborating with the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark.

Aim:

This project is to complete the work initiated by S. Clarke and S. Hoyle and presented to SC10 (as described in SC10-MI-07), and the subsequent work undertaken by the Pacific Shark Life History Expert Panel (as described in SC11-EB-13), to identify and quantify appropriate limit reference points for key shark species in the WCPO.

Scope of Work:

This project will facilitate a small workshop, or similar, of shark and stock assessment experts to undertake the following tasks:

1. For those elasmobranchs which have been evaluated using a stock assessment model, recalculate the risk-based limit reference points (as described in Table 5, SC10-MI-07) using the updated life history information produced by the Shark Life History Expert Panel.
2. For those elasmobranchs which have not been evaluated using a stock assessment model advise on ways of developing an estimate of current fishing mortality (F), for example using catch curves, the method used in the bigeye thresher assessment (SC12-SA-IP-17), or other suitable means. Risk-based LRPs (as described in SC10-MI-07) should then be developed for all WCPFC key shark species.

3. Where the stock-recruitment relationship is highly uncertain, compare F_{current} to SPR-based LRP such as $F_{60\% \text{SPR}_{\text{unfished}}}$ and discuss any new insights into the recommended estimated LRPs so that the WCPFC Scientific Committee can decide on a case-by-case basis which LRP is most appropriate.
4. Review the use or otherwise of other potential LRPs based on SPR, reduction of recruitment or empirical measures (e.g. catch rate or length values designed to signal unacceptable population states).
5. Advise on any changes or updates to the recommended LRPs in SC10-MI-07 based on new developments, including any suggestions for further technical work before consideration of adoption of LRPs by fishery managers.
6. Review the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark and assess the applicability of extending this work to other key shark species, especially South Pacific blue shark.

Output:

The project will produce a final report which shall be presented to and reviewed by SC13.

Secretariat Support:

The Principal Investigator for the project should liaise with the WCPFC Secretariat to help facilitate and coordinate arrangements for the workshop (e.g. arranging travel for the participants).

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Contents list for the development of any new shark management plans

Components to be included in a shark management plan:

- **Species:** List the shark species and stocks (if known) covered by the plan
- **Fleet:** Describe the fleet covered by the plan:
 - Enumerate the vessels catching shark and indicate whether or not they appear on the WCPFC Record of Fishing Vessels
 - Include a map indicating the coordinates of the fishing grounds for the fleet
 - Quantify the fishing effort of the fleet (in annual raised hooks fished if possible)
 - Describe the licensing arrangements applicable to the fleet and note whether effort is controlled (if so, in what way)
- **Catches:** Describe the catch arrangements of the fleet for the shark species covered by the shark management plan:
 - Provide a table showing the retained catches by the fleet of the sharks covered for the last five years (by species if possible)
 - If discards are recorded, show the quantities discarded by species and the total catch (retained + discarded)
 - Describe the mechanism for limiting the catch of sharks, by species if applicable (e.g. input/output controls, regulation, license, no-retention, etc.), and the arrangements for monitoring, verification and enforcement
 - Describe the catch limits set (e.g. X tonnes of blue shark, Y tonnes of shortfin mako shark) and provide the rationale for the limit with reference to the latest available stock assessments and reference points
 - If there are any shark species allowed to be retained but not subject to catch limits, please identify them and provide a rationale
- **Mitigation:** Describe operational practices that avoid or reduce mortality to non-retained species
 - Describe the implementation arrangements for no-retention and safe release of oceanic whitetip (CMM 2011-04) and silky (CMM 2013-08) sharks, including safe release guidelines
 - Describe implementation arrangements for the WCPFC full utilization policy (CMM 2010-07). Specifically, if fins are allowed to be removed from

- carcasses at sea, describe what arrangements are in place to demonstrate that finning is not occurring
- Identify whether shark lines or wire leaders have been prohibited (by fleet or vessel per CMM 2014-05)
 - List any other shark mitigation measures, e.g. size limits, closed areas or seasons, gear restrictions
- **Management:** Describe how the plan is implemented and reviewed
 - List the dates over which the plan applies
 - Describe how and when the plan is reviewed and reported against, including any linkages with monitoring, control and surveillance (MCS) systems
 - Describe how and when the plan is revised/renewed

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Review of the Shark Research Plan

Task: review the shark research plan adopted by SC11 (<https://www.wcpfc.int/node/21717>) and recommend any changes to the list of projects or the stock assessment schedule with particular reference to 2017.

The following ongoing or planned work is noted:

- 1) ABNJ Tuna Project (see SC12-RP-ABNJ-01) which runs through Jan 2019:
 - The southern hemisphere porbeagle assessment will be completed in early 2017
 - The Pacific-wide bigeye thresher assessment will be completed shortly
 - Two further Pacific-wide shark stock assessments (TBD) are planned (indicative budget: 100,000 USD each)
 - A post-release mortality tagging study (indicative budget: 250,000 USD)
 - A pair of international workshops planned to focus on post-release mortality tagging sampling designs and analysis (first planned for Jan 2017; all funding allocated to travel for developing coastal States and invited experts)
- 2) ISC Shark Working Group (see SC12-GN-IP-02):
 - A north Pacific blue shark assessment is in progress for completion in 2017
 - A north Pacific shortfin mako shark assessment is planned for 2018
- 3) JIMAR, NOAA and ISSF are conducting a study of post-release mortality under different handling and discard practices for blue, silky, oceanic whitetip and bigeye thresher sharks (n=112 tags with n=51 deployed to date; see SC12-EB-WP-07)
- 4) IATTC is conducting a post-release mortality study of silky sharks in Ecuador and Costa Rica (n=34) with EU funding
- 5) NOAA, SPC and ABNJ are conducting a post-release mortality tagging study of whale sharks in Papua New Guinea (n=10, none deployed yet)
- 6) Researchers from James Cook University are proposing to tag and take genetic samples from 20 silky and 20 oceanic whitetip sharks in the Cook Islands to evaluate the effectiveness of spatial management measures (see SC12-EB-IP-15)
- 7) ISSF is conducting work on FADs and sharks including entanglement and safe release

ISG6 proposed the schedule of analyses and stock assessments in Table 1 with the primary focus on the year 2017. Project outlines are provided for upcoming work.

ISG6 also made reference to the “*Principles for determining stock assessment timing and scheduling*” that were adopted by SC11

Table 1. SC12:ISG6 proposed schedule of analyses and stock assessments under the WCPFC Shark Research Plan. Project outlines are provided for some items (marked with #) and the funding source for projects in 2017 are provided in brackets. Tuna assessment schedule is for information only.

Species	Stock	Last assessment	2016	2017	2018	2019	2020
Bigeye tuna	WCPO	2014		X			X
	Pacific-wide	-					
Skipjack tuna	WCPO	2014	X			X	
Yellowfin tuna	WCPO	2014		X			X
Albacore	South Pacific	2012			X		
Striped marlin	Southwest Pacific	2012			X		
	Northwest Pacific	2012			X?		
Swordfish	Southwest Pacific	2013		X			
Silky shark	WCPO	2013					
	Pacific-wide	-		Assessment (#2) (unfunded)		Stock discrimination?	Stock discrimination?
Oceanic whitetip shark	WCPO	2012				Assessment (if data supports) (WCPFC)	
Blue shark	Southwest Pacific	-	Assessment SC12-SA-WP-08 SC12-SA-WP-09				
	South Pacific-wide						
	Northwest Pacific	2014		Assessment (ISC) Participation in ISC NP blue shark stock assessment activities (#4) (unfunded)			
Mako shark (shortfin)	Southwest Pacific	-			Assessment (if data supports)		
	Northwest Pacific	2015 (Indicator analysis)			Assessment (ISC)		

Species	Stock	Last assessment	2016	2017	2018	2019	2020
Porbeagle	Pacific-wide (southern hemisphere)	-		Assessment (to be submitted to SC13) (ABNJ)			
Bigeye thresher	Pacific-wide	-	Assessment (to be submitted to SC13)				
Hammerhead	WCPO	-			Update catch history? Biological research to determine species specific age, growth and reproductive parameters?	Stock discrimination? Biological research to determine species specific age, growth and reproductive parameters?	Stock discrimination? Biological research to determine species specific age, growth and reproductive parameters?
	Pacific-wide	-					
Whaleshark	WCPO	-			Stock discrimination?	Stock discrimination?	
	Pacific-wide	-					
General shark work	WCPO		Develop proposed limit reference points for elasmobranchs (#8) (WCPFC)	Review of shark data and modelling framework to support stock assessments (#5) (WCPFC) Post-release mortality studies in longline (#3) and purse seine fisheries (ABNJ + EU) Operational planning for shark biological data improvement (#7) (unfunded)	Assess spawner recruit relationships? SRP mid-term review?	Updated indicator analysis?	Develop a 2021-2025 shark research plan to be presented to SC16 in 2020?

Sheet Number	2
Project	Update of silky shark status as a Pacific-wide assessment
Objectives	Revisit the 2013 silky shark assessment working with IATTC* to explore stock definitions and new methods to account for potential regional patterns across the Pacific.
Rationale	<ul style="list-style-type: none"> • This species has been identified by both WCPFC and IATTC as being depleted and in need of management (and is currently proposed for CITES) • Assessment of this species is a priority shark research topic for IATTC • Leverages ABNJ funds • Four years have passed since the last WCPO assessment and two years since the implementation of WCPFC no-retention measures • Builds on previous assessment work for this species • Promotes useful cooperation with IATTC
Assumptions	<ul style="list-style-type: none"> • Much of the existing data are readily available • SPC and IATTC can collaborate and share data • Combined data prep work identifies a viable Pacific-wide assessment strategy • No-retention measures have not seriously degraded the information content of recent data • SPC workload can support undertaking this work
Scope	<p>Revisit the existing silky shark assessment (SC9-SA-WP-03) in collaboration with IATTC to improve methods, increase understanding of data strengths and weaknesses, and update stock status. Specifically:</p> <ul style="list-style-type: none"> • Explore a combined data set to determine appropriate methods • Explore ways of developing purse seine-based indices of abundance for WCPO data • Compare WCPO and IATTC indices of abundance that overlap in time and space in order to evaluate trends and define stock boundaries • Update WCPO LL catch estimates and abundance indices using recent observer data • Re-run SS3 model to compare to 2013 results • Consider what might be appropriate limit reference points • Prepare a report containing the above results for SC13
Budget	1 FTE at SPC (ABNJ can contribute up to 100,000 USD with priority on EPO extension work)

* [s](#)Subject to further discussions with IATTC staff scientists

Sheet Number	3
Project	Post-release mortality tagging study
Objectives	Obtain better estimates of post-release mortality, especially for oceanic whitetip and silky sharks, across a broader range of longline fisheries.
Rationale	<ul style="list-style-type: none"> • The data obtained will be useful for assessments as well as for evaluating the effectiveness of mitigation measures • This work can be focused on the shark species of greatest conservation and management interest • This work can reinforce several ongoing studies in other fisheries (see Preface) • Leverages ABNJ funds (funding already confirmed)
Assumptions	<ul style="list-style-type: none"> • Tags can be deployed using observers (thereby avoiding vessel costs)

	<ul style="list-style-type: none"> • Sufficient catches by vessels with trained observers onboard • Study design to be developed during an early 2017 workshop to be supported by the ABNJ Tuna Project
Scope	The ABNJ Tuna Project plans an early 2017 expert workshop to develop a sampling programme. Scope is somewhat flexible in terms of fisheries and species but at present is aimed toward longline fisheries with a priority on oceanic whitetip and silky sharks. It will be important to consider shark condition and handling practices as key factors when attaching tags, i.e. there may be a need for observers to record additional information or use different codes. ABNJ Tuna Project funding has been budgeted to buy up to 50 tags; contributions from other sources could increase the statistical power of the design. Compatibility with similar programmes in other fisheries should be maximized. This work is expected to begin in 2017 and be completed in 2018.
Budget	ABNJ has 250,000 USD budgeted for this study (other contributions welcome)

Sheet Number	4
Project	Participation in ISC North Pacific blue shark stock assessment activities
Objectives	Contribute to and learn from ISC work toward revising the North Pacific blue shark stock assessment, thereby aiding methods development for other WCPO shark stocks.
Rationale	<ul style="list-style-type: none"> • The ISC is currently conducting an update of the North Pacific blue shark stock assessment of 2014 • The ISC assessment would benefit from the contribution of additional blue shark observer data in the North Pacific • Participation in this collaborative stock assessment may lead to the development of new methods and/or new data insights • Cooperation between the WCPFC and its Northern Committee could be strengthened
Assumptions	<ul style="list-style-type: none"> • If SPC were available to participate, it would contribute its blue shark data holdings • If the Secretariat or ABNJ participates, fewer data can be contributed • ISC is able and willing to incorporate these contributions to its work • ISC meetings avoid scheduling conflicts with other work
Scope	Available WCPO data would be compiled, formatted and analysed to produce data products that could be contributed to ISC Shark Working Group (SWG) meetings (no raw data would be contributed; this is similar to the contributions of ISC member countries). It is assumed that participation in two ISC SWG meetings would be required (the FTE estimate is intended to account for travel costs). Total time input including data handling and analysis, ISC SWG meetings and other tasks, and report review is estimated at ~2.5 months. The ISC SWG aims to complete its North Pacific blue shark stock assessment in the first half of 2017.
Budget	\$20,000

Sheet Number	5
Project	Review of shark data and modelling framework to support stock assessments
Objectives	Implement a review of the data availability, data quality and data gaps for undertaking shark assessments, and the associated need to identify appropriate data assumptions for re-constructing data time-series and appropriate modelling techniques

Rationale	<ul style="list-style-type: none"> • Implements recommendations from the South Pacific blue shark, the 2016 SPC data gaps paper and the BDEP paper regarding the need to inspect and clean existing shark data holdings • Assessments usually do not have time for this type of work, and general data management budgets do not provide for this depth of focus • While providing an improved understanding of existing data holdings and their utility for assessments, the project would also improve the modelling framework to be used in shark assessments.
Assumptions	<ul style="list-style-type: none"> • Would require either SPC, or a consultant working with SPC, so that all data holdings that are usually accessed for stock assessments can be included.
Scope	<p>This study should be conducted by a scientist familiar with shark biology and assessment methods (not by a data management generalist). The review should cover all WCPFC key species and include:</p> <ul style="list-style-type: none"> • Assess the quality of the data currently held including the spatial and temporal coverage of logbook and observer data, • Identify significant data gaps and the uncertainties which these gaps imply, • Comparing observer and logsheet data with a view to identifying and adjusting for under-reporting, discarding, non-species specific recording and other missing data, • Assess impact of specific shark related CMMs on data quality, • Investigate data reporting patterns by fleet including whether i) annual catches and discards are reported for all key species; ii) whether operational or aggregated logsheet data are provided for all key species; and iii) the extent to which the provided data are estimated and how that might affect their precision, • Identify mechanisms to addressing the current data gaps including identifying potential sources of new historical data, • Identify appropriate data assumptions for re-constructing data time-series and propose methods (e.g. weighting, extrapolation, etc.) to adjust for identified biases, • Provide advice on what types of analyses the data can support including advice on appropriate modelling approaches (e.g. CPUE standardisation) where the data is considered sufficient, • Produce a paper containing recommendations, and revised datasets as appropriate, for SC13.
Budget	\$65,000

Sheet Number	6
Project	Operational and management histories for WCPO longline fleets
Objectives	Compile timelines and brief descriptions for major longline fleets detailing the history of management measures and operational practices
Rationale	<ul style="list-style-type: none"> • This project addresses an SC11 (and prior) discussion about how to interpret changes in CPUE indices and the potential biases in constructing indices of stock abundance based on standardised CPUE from various fleets' data without knowing and adequately accounting for operational and management changes over time. • As indices of stock abundance are one of the key inputs to stock assessment models, adequately accounting for changes in operational practices that may

	<p>influence CPUE is a high priority.</p> <ul style="list-style-type: none"> • Australia has produced a simple fleet history that can serve as a template for other CCMs (SC12-SA-IP-11). • These histories would serve as a resource not only for WCPFC analyses but for any analyses of Pacific shark data
Assumptions	<ul style="list-style-type: none"> • The information exists and can be located in a reasonable timeframe • CCMs are willing to assist with producing their own fleet histories • Funding is available to assist CCMs in producing their summaries (if they wish)
Scope	<p>The fleet histories should, in the first instance, focus on longline fleets as it is these data that are often used as indices of stock abundance. Separate fleet histories for purse seine fleets could also be prepared as resources allow. The fleet histories should include details on management measures, fishing strategies, gears and sampling regimes over time. It is anticipated that each history would be up to 3 pages of text with key events described in sequence, with a few key figures and an excel spreadsheet version of the timeline.</p> <p>A coordinator should be appointed to compile and assist with the fleet histories. For those CCMs that are willing to produce their own fleet histories, the coordinator would just be involved in editing and formatting. For those CCMs that are willing to have a fleet history produced but cannot undertake it themselves the coordinator could assist in writing up information or interviews facilitated by the CCM for approval by the CCM. At a minimum, the coordinator could research and pull together public domain information for each fleet.</p> <p>A collection of fleet histories would be presented by the coordinator to SC13, with the potential for CCMs to update or replace them over time.</p>
Budget	\$30,000

Sheet Number	7
Project	Operational planning for shark biological data improvement
Objectives	Collect, review and prioritize a list of biological data gaps for the WCPFC key shark species and propose a scalable and practical plan for filling them
Rationale	<ul style="list-style-type: none"> • The Pacific Shark Life History Expert Panel Workshop urged the t-RFMOs to be more proactive in setting a research agenda for life history and stock structure research • ISC and ICCAT have developed mechanisms for this type of work, but there is little shark biological work being done by the WCPFC • Various recommendations for further studies have been made by the Shark Research Plan, various stock assessments and the Expert Panel itself. • The regional observer programme and SPC tissue bank provide opportunities for sample collection and access • It is difficult to begin filling data gaps without a focused, practical plan that can be proposed and costed • This project will develop such a plan, thereby spinning-off implementable projects that can proceed if funded
Assumptions	<ul style="list-style-type: none"> • There are cost-effective ways of gathering the necessary data and conducting the appropriate analyses • CCMs may be able to assist with sample collection or other research

	coordination <ul style="list-style-type: none"> • SPC or another regional body is willing to act as the focal point • At least some of the projects developed can be funded through WCPFC or other sources
Scope	Review the Shark Research Plan, shark stock assessments in the WCPO and elsewhere, the report of the Pacific Shark Life History Expert Panel Workshop to develop a list of biological studies necessary to support conservation and management for WCPFC key shark species, potentially including: <ul style="list-style-type: none"> • Stock discrimination • Age and growth sampling • Inter-laboratory calibration of ageing methods • Validation/verification of ageing methods • Reproductive sampling • Length-length and length-weight relationships • Movement/migration Prioritize these studies based on the usefulness of the information, ease of sample access and cost and develop practical plans (including a budget) such that priority studies can proceed as soon as funding is sourced. A minimum of three studies should be fully developed, organized and costed and tabled at SC13.
Budget	\$30,000

Sheet Number	8
Project	Identifying appropriate Limit Reference Points (LRPs) for elasmobranchs within the WCPFC (Scope for Commission approved project)
<p>Background: The Commission endorsed SC11's request of USD 25,000 for the continued development of limit reference points for elasmobranchs. The Commission tasked SC12 to develop a scope of work to progress this work within the budget allocated for 2016 (Paras 69-70, FAC9 Summary Report). SC12-ISG-2 also supported the project collaborating with the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark.</p> <p>Aim: This project is to complete the work initiated by S. Clarke and S. Hoyle and presented to SC10 (as described in SC10-MI-07), and the subsequent work undertaken by the Pacific Shark Life History Expert Panel (as described in SC11-EB-13), to identify and quantify appropriate limit reference points for key shark species in the WCPO.</p> <p>Scope of Work: This project will facilitate a small workshop of shark and stock assessment experts to undertake the following tasks:</p> <ol style="list-style-type: none"> 1. For those elasmobranchs which have been evaluated using a stock assessment model, recalculate the risk-based limit reference points (as described in Table 5, SC10-MI-07) using the updated life history information produced by the Shark Life History Expert Panel. 2. For those elasmobranchs which have not been evaluated using a stock assessment model advise on ways of developing an estimate of current fishing mortality (F), for example using catch curves, the method used in the bigeye thresher assessment (SC12-SA-IP-17), or other suitable means. Risk-based LRPs (as described in SC10-MI-07) should then be developed for all WCPFC key shark species. 3. Where the stock-recruitment relationship is highly uncertain, compare F_{current} to SPR-based LRP such as $F_{60\%SPR_{\text{unfished}}}$ and discuss any new insights into the recommended estimated LRPs so that the 	

WCPFC Scientific Committee can decide on a case-by-case basis which LRP is most appropriate.

4. Review the use or otherwise of other potential LRPs based on SPR, reduction of recruitment or empirical measures (e.g. catch rate or length values designed to signal unacceptable population states).
5. Advise on any changes or updates to the recommended LRPs in SC10-MI-07 based on new developments, including any suggestions for further technical work before consideration of adoption of LRPs by fishery managers.
6. Review the work presently being undertaken by ISC on the development of stock-recruitment relationships and their parameter estimates, such as stock-recruitment steepness for North Pacific blue shark and assess the applicability of extending this work to other key shark species, especially South Pacific blue shark.

Output:

The project will produce a final report which shall be presented to and reviewed by SC13.

Secretariat Support:

The Principal Investigator for the project should liaise with the WCPFC Secretariat to help facilitate and coordinate arrangements for the workshop (e.g. arranging travel for the participants).

Timing:

The Commission allocates funds on an annual basis. As such, the project funds would need to be spent or contracted in 2016/17, otherwise the Commission would need to re-approve funding for this project at WCPFC13.

Budget

\$25,000 (Commission funding approved for 2016)

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

**Scientific Committee
Twelfth Regular Session**

Bali, Republic of Indonesia
3-11 August 2016

WCPFC Tissue Bank Access Protocols

Background

1. The WCPFC has established a tissue bank of biological samples collected from pelagic species in the WCPO for the purposes of studies to advance fisheries management in the WCPO. The bank contains otoliths, fin spines, gonads, liver, muscle, stomach and blood from tuna, billfish and other pelagic species.
2. The purpose of this document is to specify the rules for scientific researchers to access these samples for the purpose of scientific study.
3. For projects approved and funded by the WCPFC, nominated researchers who have identified their need to access the WCPFC tissue bank to undertake the project do not have to follow the selection and approval process set out in paragraph 10 below. However, all the other access protocols will apply to such access.
4. In the planning stages of a project, applications by researchers to access the web-data tool for meta-data describing the WCPFC tissue bank's samples should be sought from the WCPFC Scientific Services Provider. The Scientific Services Provider will only supply such a log-in to allow the project's researchers appropriate access and for a limited period of time.

Rules and Procedures

5. Applications to access samples from the tissue bank should be addressed to the Executive Director, WCPFC Secretariat and must include:
 - a. WCPFC Scientific Committee Project Name, Project Number, Objectives, or recommendation if applicable
 - b.
 - c. Specification of the samples to be withdrawn from the bank (number, type, species, size of sample and proportion of available sample to be used, any location/sex/date limits, etc.)
 - d. The methods for processing and analyses of the samples (in particular whether the method will destroy part or all of a sample, and what sample record will be retained, e.g. sectioned otolith slides)
 - e. Past contributions to the tissue bank by the researcher or CCM
 - f. Intended collaborations with other researchers or institutions
 - g. Timeline for the study and intended outcomes.

Additional information may be requested from the researcher by the WCPFC Research Sub-Committee or the WCPFC Secretariat to assist in considering the application.

6. It will be a requirement of access to the WCPFC tissue bank for the researcher or CCM to provide an annual report to the Executive Director, WCPFC Secretariat. This must include documentation of raw and analysed results, however this does not imply a requirement for this data to be publicly available. When data can be made publicly available a report to WCPFC's Scientific Committee is required on progress of the study. The reports must follow WCPFC standards and must include method description and meta data. All data derived from WCPFC tissue bank samples will become publicly available 5 years after WCPFC Secretariat determines the project analyses are complete or at WCPFC's discretion.

7. The WCPFC Research Sub-Committee will give consideration to the sequencing of analyses such that those which involve the samples being destroyed or modified are undertaken last when approving applications. For example otolith weight and morphometric analyses may be prioritised before sectioning, which may be prioritised before chemical analyses.

8. Where the analyses involve the preparation of secondary products such as sectioned otoliths and histological slides these products are to be provided to the WCPFC tissue bank at the completion of the study for future curation, comparative reference and study.

9. Researchers or CCM's must acknowledge the WCPFC tissue bank in any publication of results from the study undertaken.

10. The selection and approval of projects will be determined by the WCPFC Research Sub-Committee. This sub-committee may meet within the margins of WCPFC meetings or electronically. This sub-committee will prepare and submit a summary of its decision on each project proposal to the WCPFC Executive Director for final approval. Decisions should be taken within 30 days of the application being received. The project approval process will consider, inter alia, the following:

- a. Preferential access to the tissue bank will be given to researchers or WCPFC CCM's who have contributed to the collection of samples,
- b. Preferential access to the tissue bank will be given to collaborative projects with priority to those where the collaboration includes the WCPFC Science Services Provider and more than one WCPFC CCM.
- c. Priority will be given to requests that are part of the WCPFC Scientific Committee's research and work plan and those projects whose spatial scale is regional in preference to local and
- d. Past participation with those who acknowledge the source of the samples and provide secondary products as required above given priority.

11. Once approval for access to samples from the tissue bank has been provided by the WCPFC Research Sub-Committee the researcher/CCM will enter into a formal agreement with the Secretariat of the WCPFC that will specify access requirements, reporting and any data confidentiality that the WCPFC may require.

12. A reasonable fee may be charged for the cost associated with preparing the samples for shipping and cost recovery for freight or transport agent fees and freight (loss and damage) insurance. An additional fee will be charged to applications from researchers or institutions ~~who~~ that are not associated with WCPFC CCMs. This fee will be based on the full cost recovery of the collection of samples requested (estimated at USD10 per sample in 2015). The total amount of this second fee that is collected in each year will be used to offset WCPFC's costs of running the tissue bank in the following year.

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SC12 Work Programme and Budget for 2017-2019

Table 1: List of SC work programme titles and budget for 2017, and indicative budget for 2018–2019, which require funding from the Commission’s core budget. Other projects also prioritised by SC12 without funding request are also listed to indicate the support by SC12 for those projects.

(Budget in USD)

Project title	TORs	Essential	Priority / Rank	2017	2018	2019
SPC Oceanic Fisheries Programme Budget		Yes		871,200	871,200	871,200
SPC – Additional resourcing for harvest strategy evaluation, including stock assessments		Yes		160,000	160,000	160,000
Project 14. West Pacific East Asia (WPEA) Project		Yes		25,000	25,000	25,000
Project 35b. Maintenance and enhancement of the WCPFC Tissue Bank	Annexed	Yes	High	95,000	95,000	95,000
Project 42 Pacific Tuna Tagging Programme (PTTP) <i>Additional funding required from external sources</i>	Annexed	Yes	High	250,000 950,000	500,000 190,000	650,000 550,000
Project 60: Further paired sampling and unloading data comparisons.	Annexed		Medium / 1	50,000	0	0
Project 67: Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area	Annexed		Medium / 4	40,000	40,000	30,000
Project 68. Estimation of seabird mortality across the WCPO Convention area	Annexed		Medium / 3	72,500	22,500	17,500
Project 78 Review of shark data and modelling framework to support stock assessments	Annexed		Medium / 2	65,000	0	0
Project 79 Spatial longline analyses in support of bigeye tuna management in the WCPFC	Annexed		NR ¹	NBR ²	0	0
Unobligated (Contingency) Budget <i>Note:</i> Any science-related projects requested by the Commission with no budget allocation				83,000	83,000	83,000
SC12 TOTAL BUDGET	Excluding External Funding of Project 42			1,711,700	1,796,700	1,931,700
	Including External Funding for Project 42			2,661,700	1,986,700	2,481,700

¹ NR = Not Ranked ² NBR = No Budget Request from WCPFC

TERMS OF REFERENCE / SCOPE OF WORK

PROJECT 35B

Collection and evaluation of purse-seine species composition data

The scope of work will include, but not limited to, the following:

- Maintain and develop:
 - the public SPC webpage informing interested parties of the tissue bank, including the rules of procedure to access samples from the tissue bank.
 - a web-accessed database holding non-public data
 - a relational database that catalogues the samples to include fishery/sampling metadata
- Tissue sample utilisation and a record of outcomes/outputs will also be detailed in the relational database.
- Subject to approval by the WCPFC Executive Director:
 - metadata will be made available to institutions or organizations responsible for providing scientific advice in fisheries through the web-accessible component of the database, and subsequently,
 - SPC-OFP will facilitate the transmission of requested samples to specified researchers/organisations, and the return of unused and/or processed samples to the relevant storage facility.

Additional \$15,000 to Project 35B

Australia has provided access to their quarantine and sample storage infrastructure through CSIRO. To date this has been an in-kind contribution to the operation of the tuna tissue bank. The challenge is that although the samples are stored, they are not curated which makes access when needed very difficult and time consuming. It is also creating problems with quarantine data. This work would see the samples curated at the Brisbane site on an ongoing basis and eliminate the quarantine issues. CSIRO can commit to the in-kind contribution of maintaining space and transfer of specimens on an ongoing basis with this funding for sorting and curation.)

This proposal is to extend aspects of the existing WCPFC tissue bank. The funding is additional to the existing ongoing budget for Project 35b. The scope of this extension work is to curate and store specimens at an additional site.

The specific work is to:

- Sort specimens on arrival and reconcile with quarantine data
- Enter data describing specimens received into BioDaSys
- Store specimens systematically so that they can be retrieved when requested

Laboratory and storage materials to complete curation

PROJECT 42 (REVISED PROPOSAL)

Pacific Tuna Tagging Programme (PTTP)

It has been highlighted in SC12-SA-WP-04, SC12-MI-WP-05 and SC12-RP-PTTP-01 that regular tagging is required to support stock assessment and harvest strategy implementation for tropical tuna.

SC12-RP-PTTP-01 proposed that skipjack and yellowfin focused tagging using pole-and-line fishing and bigeye tagging using handline fishing be conducted in alternate years.

The following funding support would be required to implement this work, which would target the release of 20,000 SKJ and 5,000 YFT in each pole-and-line cruise and 2,000 BET in each handline fishing cruise. The two budget columns below refer to the alternating years targeting SKJ/YFT and BET:

Budget item	SKJ+YFT (PL)	BET (HL)
Vessel charter	600,000	300,000
Tags/equipment	150,000	100,000
Personnel	150,000	100,000
Tag recovery	300,000	100,000
Admin/reporting	180,000	90,000
TOTAL	1,380,000	690,000

PROJECT 60

Collection and Evaluation of Purse-Seine Species Composition Data

The scope of work will include, but not limited to, the following items below:

- a. Continue to identify key sources of sampling bias in the manner in which species composition data are currently collected from WCPO purse seine fisheries and investigate how such biases can be reduced
- b. Review a broad range of sampling schemes at sea as well as onshore; develop appropriate sampling designs to obtain unbiased species composition data by evaluating the selected sampling procedures; extend sampling to include fleets, areas and set types where no representative sampling has taken place; verify, where possible, the results of the paired sampling against cannery, unloading and port sampling data
- c. Review current stock assessment input data in relation to purse-seine species composition and investigate any other areas to be improved in species composition data, including the improvements of the accuracy of collected data,
- d. Update standard spill sampling methodology if required.
- e. Analyse additional data collected to evaluate the benefits of spill sampling compared to corrected grab-sampling.

2016-18 Tasks

This work should be progressed by the following activities:

- Subject to the availability of data, analyse the spill and grab sampling data for the trips conducted on PNG purse seiners in 2014, and compare those results to the estimates of species composition obtained from intensive port sampling.
- Undertake additional observer sampling / unloading comparisons where it is possible to conduct paired sampling trials and obtain accurate estimates of catch by species for the same trips from unloadings.
- Extend the comparisons of grab- and spill-sampling-based species composition with accurate unloadings data to include the comparison of grab samples corrected for selectivity bias with the unloadings data.
- Where possible and logistically feasible, observer programmes should continue to undertake paired sampling trials on a limited basis (say 10 trips per year) to continue to refine estimates of selectivity bias and to support additional simulation modelling.

- Undertake additional simulation modelling to estimate precision and bias of using corrected spill sampling data as the basis for estimating purse seine species composition at various levels of resolution.
- Consider other work in progress to assess the accuracy of cannery records with respect to estimates of species composition at the trip level. If accurate data could be obtained from canneries, it would be an invaluable additional source of information for the estimation of species composition of the purse seine catch.

PROJECT 67

Review of impacts of recent high catches of skipjack on fisheries on the margins of the WCPFC Convention Area

(For 2016)

Data update until 2015 and down scale the new optimization at coarse resolution to the corrected GLORYS + Mercator operational model and conduct fishing impact and connectivity analysis. The progress will be presented at the SC13 as well as preliminary results of otolith data analysis.

(For 2017-2019)

SEAPODYM work, Tagging activities, including ~~in~~ sub-tropical and temperate regions, genetic analysis and otolith analysis focusing on early growth rate to provide better information on stock connectivity and movement.

1. SEAPODYM works to investigate spatial fishing impact in the WCPO (continue)
2. Collection and analysis of genetic samples from skipjack around Japan and in various areas of the equatorial fishery, to potentially determine the likely spawning ground origin of skipjack around Japan.
3. Otolith data analysis to identify spawning or hatching area using different growth pattern in different areas (2 years : preliminary analysis using Japanese data and tissue bank data)
4. tagging activities in sub-tropical and template regions to provide better information on stock connectivity and movement (this is in relation to SC11 recommendation)

PROJECT 68

Estimation of seabird mortality across the WCPO Convention area

- Fulfil the requirement under the WCPFC seabird CMMs to estimate the total number of seabirds being killed per year in WCPFC fisheries.
- Assess mortality per year over the ten years since the first WCPFC seabird CMM, as requested under CMM2006-02, CMM 2007-04 and CMM 2012-07, and assess whether there is any detectable trend.
- Describe the methods used to estimate total mortality, including treatment of data gaps, and
- Identify the limitations in the data available, allowing the SC to generate advice to the Commission on what improvements are needed to enable better analyses to be made.
- Generate advice on what further level of seabird assessment at species or species-group level can be conducted, given the amount and quality of data currently available

PROJECT 78**Review of shark data and modelling framework to support stock assessments**

Objectives	Implement a review of the data availability, data quality and data gaps for undertaking shark assessments, and the associated need to identify appropriate data assumptions for re-constructing data time-series and appropriate modelling techniques
Rationale	<ul style="list-style-type: none"> • Implements recommendations from the South Pacific blue shark, the 2016 SPC data gaps paper and the BDEP paper regarding the need to inspect and clean existing shark data holdings • Assessments usually do not have time for this type of work, and general data management budgets do not provide for this depth of focus • While providing an improved understanding of existing data holdings and their utility for assessments, the project would also improve the modelling framework to be used in shark assessments.
Assumptions	<ul style="list-style-type: none"> • Would require either SPC, or a consultant working with SPC, so that all data holdings that are usually accessed for stock assessments can be included.
Scope	<p>This study should be conducted by a scientist familiar with shark biology and assessment methods (not by a data management generalist). The review should cover all WCPFC key species and include:</p> <ul style="list-style-type: none"> • Assess the quality of the data currently held including the spatial and temporal coverage of logbook and observer data, • Identify significant data gaps and the uncertainties which these gaps imply, • Comparing observer and logsheet data with a view to identifying and adjusting for under-reporting, discarding, non-species specific recording and other missing data, • Assess impact of specific shark related CMMs on data quality, • Investigate data reporting patterns by fleet including whether i) annual catches and discards are reported for all key species; ii) whether operational or aggregated logsheet data are provided for all key species; and iii) the extent to which the provided data are estimated and how that might affect their precision, • Identify mechanisms to addressing the current data gaps including identifying potential sources of new historical data, • Identify appropriate data assumptions for re-constructing data time-series and propose methods (e.g. weighting, extrapolation, etc.) to adjust for identified biases, • Provide advice on what types of analyses the data can support including advice on appropriate modelling approaches (e.g. CPUE standardisation) where the data is considered sufficient, • Produce a paper containing recommendations, and revised datasets as appropriate, for SC13.
Budget	\$65,000

PROJECT 79**Spatial longline analyses in support of bigeye tuna management in the WCPFC**

Objective	Conduct Multifan-CL projections to provide managers information on spatial aspects of regional depletion due to longline fishing
Rationale	Regarding fishing mortality, the WCPFC SC has previously commented on spatial considerations given high fishing exploitation rates and fishery depletion in some regions of the MFCL assessment. The SC has expressed concern with regard to depletion in some regions for both yellowfin and bigeye tuna.
Assumptions	<ol style="list-style-type: none">1) Structure of analyses which would use the 2014 bigeye tuna reference case assessment in the western and central Pacific Ocean with deterministic projections;2) Using recent average recruitment (2002 - 2011);3) Using 2015 purse seine choices for future effort levels; and4) Using 2012 catch in the Philippines and Indonesia.
Scope	Identify alternative levels of regional longline bigeye catch (relative to those in 2012) that achieve fishing mortality at the Maximum Sustainable Yield (Fmsy) level within a certain time frame, such as initially 10 years or additionally in 20 years if computationally feasible. Identified runs could include: <ol style="list-style-type: none">1) Scenario 1 - The analysis would identify combinations of longline effort that represent similar regional exploitation rates and estimate a time-series of regional catches that achieved Fmsy in the time frame. Outputs would be a time-series of regional catch and effort and depletion.2) Scenario 2 – The analysis would identify combinations of longline effort that represent similar regional depletion estimates and achieve Fmsy in the time frame. Outputs would be a time-series of regional catch and effort and depletion.
Expected outcomes	Regional understanding of longline effort and bigeye catch resulting from differing assumptions on using similar exploitation rates or obtaining similar depletion among regions
Budget	The U.S. is willing to make a voluntary contribution to WCPFC in support of these analyses.

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Process for the independent review of stock assessments

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

RECOGNIZING the importance of sound scientific advice as the central piece for the conservation and management of tuna and tuna-like species in the Western and Central Pacific Ocean;

AWARE that the availability of adequate scientific information is fundamental to carrying out the objectives of the WCPFC Convention laid down in its Article 2;

NOTING the role of the Oceanic Fisheries Programme of the Pacific Community (SPC-OFP) which is contracted to provide independent scientific advice;

ACKNOWLEDGING the need to ensure that relevant, professionally independent and objective scientific advice, based on the best available and peer-reviewed scientific analysis, be provided by the Scientific Committee to the Commission;

Implements the following processes for the independent review of WCPFC stock assessments conducted by the SPC-OFP and encourage a comparable process⁷ for non SPC-OFP WCPFC stock assessments:

Scientific Committee's recommendation to the Commission

1. The Scientific Committee should recommend a multi-year schedule for independent peer review of stock assessments.
2. The Scientific Committee will recommend to the Commission a specific independent peer review for a stock assessment, with an associated budget. The peer review panel will comprise three (3) independent experts. The budget will include consultancy fees, pre-workshop study, travel costs etc. and the peer review chair's attendance to report at the following Scientific Committee meeting.

Commission's approval of the peer review

3. The Commission at its annual meeting will consider the recommendation (Para 2. above) from the Scientific Committee for an independent peer review of a stock assessment and the associated budget.

⁷ It is noted that the science provider to the Northern Committee, the ISC, is developing an interactive independent expert peer review process informed in part by this document.

4. Subject to the Commission's approval, the Scientific Committee will be tasked to develop Terms of Reference for the upcoming peer review and the Secretariat to implement the peer review process.

Selection of the independent peer review panel

5. The WCPFC secretariat is responsible for administering the selection and timely contracting of the three (3) independent peer reviewers.

- 1) The Secretariat will distribute a Circular seeking Member's nomination of candidate experts.
- 2) Each Member may recommend a maximum of two candidates⁸ through their official WCPFC contacts.
- 3) Subject to the availability of the recommended experts and agreement with the terms of reference, the Science Research Sub-Committee comprising the -SC Chair, the SC Theme Conveners and the Chief Scientist SPC-OFP will select eight candidates for short listing, and circulate the shortlist with their curriculum vitae to all Members.
- 4) Each Member will rank the eight candidates with scores 1 (most preferred) to 8 (less preferred) and submit these rankings to the Executive Director.
- 5) The Secretariat will finalize the list of the peer review panel and contract with the three (3) experts. If any of the selected three (3) individuals are unable to undertake the review, the shortlisted candidate next in rank will be invited to join the peer review panel.

Panel's review process

6. At the start of the review process, SPC-OFP will prepare a procedural plan including detailed schedules, activities, provision of assessment results (possibly including all the input data, modeling software, output of basic runs as well as all the sensitivity runs) and provide these to the panel for advanced reviewing.

7. Once the review process is finished, a draft review report will be provided to SPC-OFP for their review and response. If time permits, this step may be concluded towards the end of the peer review workshop.

8. The final panel report, incorporated with SPC-OFP's response(s) and the panel's feedback to SPC-OFP if needed, shall be submitted to the WCPFC Executive Director, in advance of the following Scientific Committee meeting as scheduled in the contract.

9. The Chair of the independent peer review panel will be expected to present the results of the review to the following Scientific Committee meeting.

10. In preparing and conducting the review process, due considerations will be devoted to the following elements.

- a) Location

⁸ The nomination may be for an individual or it may be to approach an organisation e.g. IATTC to provide an appropriate expert.

Peer reviews of stock assessments will be conducted at the headquarters of SPC-OFP in Noumea, New Caledonia.

b) Duration

Subject to species, a five (5) day workshop is proposed, comprising a two (2) day period for peer reviewing the stock assessment, and a further three (3) day period for iteratively reviewing and advising on various aspects of subsequent assessment runs developed in light of the first two days.

c) Scheduling

Timing is dependent upon existing schedules of the SPC-OFP, the WCPFC Secretariat and the selection process and availability of the independent expert peer reviewers. The Chair of the peer review panel will present the review to the following Scientific Committee.

d) Composition

The peer review panel should comprise three (3) independent scientists that have significant expertise and experience in all aspects of stock assessments, preferably in relation to the stock assessment under review; one of whom will be assigned the role of Chair. The reviewers should not be directly involved with current WCPFC stock assessments.

Attendance to the peer review workshop will be limited to the peer review panel members, scientists directly involved in the relevant assessments, and the Secretariat as a coordinator of the whole process.

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Indonesian intervention for the research needs on IUU fishing in WCPFC

RECALLING that the FAO Council adopted on 23 June 2001 an International Plan of Action to prevent, to deter and eliminate illegal, unreported and unregulated fishing (IPOA-IUU),

CONCERNED by the fact that IUU fishing activities in the WCPFC area of competence continue, and these activities diminish the effectiveness of WCPFC Conservation and Management Measures,

CONSCIOUS of the need to address, as a matter of priority, the issue of large-scale fishing vessels conducting IUU fishing activities,

NOTING that the situation must be addressed in the light of all relevant international fisheries instruments,

RECOGNIZING that IUU fishing is a very serious and organized crime, involving slavery and smuggling,

Also recognizing that neglecting of IUU Fishing in the provision of scientific advice will potentially enhance uncertainties and lead to fisheries management failure, threatening not only the fish resources but also the livelihoods of millions of peoples who rely on fishing,

Therefore, we propose that this Scientific Committee should have a very important role to develop tools to identify IUU fishing statistics and conduct analysis to deliver appropriate advice to the managers right on time, for the reduction and elimination of IUU Fishing activities.

As we are aware the Scientific Committee does not cover IUU fishing statistics and stock assessment does not include the estimated catch from IUU fishing and related activities. We assume the total tuna catch from such IUU activities might be substantial and add more uncertainties in the stock assessment.

In order to increase the accuracy of the stock assessment, we need to consider that the Scientific Committee should have an opportunity to conduct specific research to estimate the catch from IUU fishing and related activities.